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FOREWORD

The *United States Armed Forces Medical Journal* is the medium for disseminating information of administrative and professional interest to all medical personnel of the Department of Defense. The Chairman of the Armed Forces Medical Policy Council and the Surgeons General of the several services invite all medical officers, dental officers, Medical Service Corps officers, Nurse Corps officers, and officers of the Veterinary Corps of the Armed Forces, and the medical consultants of the Army, Navy, and Air Force to submit manuscripts for publication in this *Journal.*

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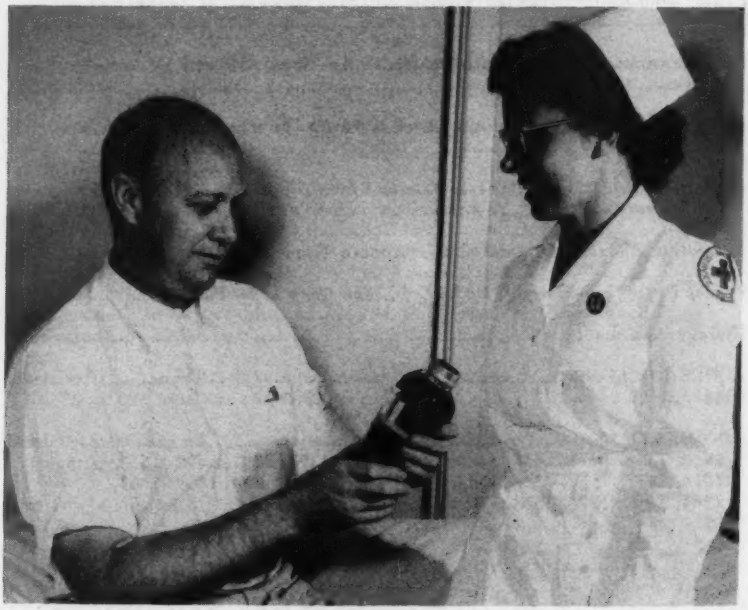
Monthly Message

In the picture shown below Dr. Melvin A. Casberg, Chairman of the Armed Forces Medical Policy Council, Office of the Secretary of Defense, has just contributed a pint of blood to the National Blood Program through the Red Cross.



In connection with this Program, Dr. Casberg said, "Let everyone of us continue the splendid efforts of the Military Services in supporting the National Blood Program—an indication that we are keeping faith with the troops who are giving so fully of themselves in Korea!"

THROMBOPHLEBITIS IN GUAM

LAWRENCE L. BEAN, *Captain, MC, U. S. N. (1)*

THROMBOPHLEBITIS, phlebothrombosis, iliofemoral thrombosis, superficial phlebitis with thrombosis, thrombophlebitis migrans, idiopathic thrombophlebitis, and recurrent thrombophlebitis appear to be either different stages of the same phenomenon or to derive their names from the varied locations in which they appear. This article is presented to demonstrate the effect of climatic conditions on this disease.

Arnett *(2)* noticed that following operation or trauma, new platelets which may be more adhesive than the old are formed. The viscosity of the blood and the rise in fibrinogen concentration, plus the slowing of the venous flow, especially in the lower extremities, undoubtedly play a part in the formation of thrombi. Thrombosis also occurs as a complication of carcinoma, cardiac diseases, splenectomy, and blood dyscrasias *(3)*.

Quick *(4)* explained the promotion and propagation of a thrombus within a vein on the basis of the contraction of a post-traumatic thrombus which exudes a serum rich in nascent thrombin. If the circulation is sluggish, this serum will not be washed away but will cause the formation of a secondary thrombus. On the other hand, McLachlin and Paterson *(5)*, in a series of dissections of 100 veins found that 73 percent of the thrombi were from the thigh and pelvic veins; 31 arose in direct relation to a valve pocket (due to eddying of the blood). They found no intimal changes at the site of thrombi which would act as a precipitating factor in thrombus formation.

Aycock and Hendrick *(3)* postulated that there are more cases in the North than in the South because of the greater incidence of upper respiratory infections. These and other investigators narrow the current thought on the cause of thrombosis to increased platelets, increased fibrinogen, damaged intima, or changes in the viscosity of the blood and its rate of flow. One or

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(1) U. S. Naval Hospital, Guam, at time of writing, now at U. S. Naval Hospital, Great Lakes, Ill.

(2) Arnett, W. M.: Discussion on management of thrombophlebitis. Proc. Roy Soc. Med. 44: 499-510, June 1951.

(3) Aycock, T. B., and Hendrick, J. W.: Problem of venous thrombosis. J. A. M. A. 133: 1258-1263, Apr. 26, 1947.

(4) Quick, A. J.: New concept of venous thrombosis. Surg., Gynec. & Obst. 91: 296-300, Sept. 1950.

(5) McLachlin, J., and Paterson, J. C.: Some basic observations on venous thrombosis and pulmonary embolism. Surg., Gynec. & Obst. 93: 1-8, July 1951.

all, or any combination, could be correct, but other factors yet to be determined could also be causative. Ackerman and Estes *(6)* summed up the matter by saying: "After all situations have been considered which are known to be etiological factors in the production of thrombophlebitis, there remains a group of patients in whom thrombophlebitis develops without apparent cause."

With regard to the site of the formation of the thrombi, Aycock and Hendrick *(3)* stated that in *phlebothrombosis* the thrombus most frequently develops in the plantar veins of the foot, spreads to the deep calf muscles, and propagates itself into the deep veins of the thigh and pelvis. Pulmonary embolus may result. Gerber and Mendlowitz *(7)* agree with this. *Thrombophlebitis* completely occludes the vein and usually begins in the deep veins of the thigh and pelvis. Fewer pulmonary emboli result, but a painful edematous leg is often the late result. It is also believed that thrombophlebitis is a late result or the continuation of a phlebothrombosis. The iliopelvic and iliofemoral types described by some English writers are actually thrombophlebitis of the pelvic and femoral veins and not a distinct entity.

The superficial type of thrombosis as seen in the long saphenous vein is more a true phlebitis than a thrombophlebitis. Although it does contain a thrombus, it is not a likely source of emboli.

An outstanding characteristic of thrombophlebitis and its related entities in Guam is its rarity. Over 2,400 operations, including several splenectomies, many cholecystectomies, many operations on the kidneys, stomach, and intestines, and operations for cancer, were performed in 1950 and 1951 with only 1 case of thrombophlebitis and that case terminated fatally (case 6). The surgical staff of the naval hospital here was alert in searching for early or late signs and symptoms of this condition. In over 1,000 deliveries during the same time, not 1 case developed. The obstetric staff was also searching for evidence of thrombosis.

The climate here is warm but very even, varying from 72° F. at night to 85° F. in the daytime. There is a slight increase in August and September. The trade winds provide a cool breeze. Most of the time the humidity is unusually high and the annual rainfall averages 55 inches.

Although most of the operations were on young healthy pa-

(6) Ackerman, R. G., and Estes, J. E.: Prognosis in idiopathic thrombophlebitis. Ann. Int. Med. 34: 902-910, Apr. 1951.

(7) Gerber, I. E., and Mendlowitz, M.: Visceral thrombophlebitis migrans. Ann. Int. Med. 30: 560-579, Mar. 1949.

tients, many were on elderly dependents of service personnel and natives of Guam. Several patients with thrombophlebitis were admitted and treated on both the medical and surgical services. In all of these the onset was spontaneous or followed a minor trauma or mild illness and most of them were severe. Two of the cases reported below required ligation of the vena cava and 4 others had to be evacuated to the United States. Five of the more severe cases are reported to illustrate (1) the difficulty in making the diagnosis, (2) the minor trauma which caused them, (3) the difficulty in treatment if accurate prothrombin examinations are not available, and (4) the regimen carried out. A total of 17 cases were observed in the 2-year period.

Any means which diminishes or slows clot retraction should be valuable prophylactically against thrombosis. The reduction of the number of circulating platelets is a theoretical means but it is not feasible clinically. The reduction of the potential formation of thrombin is readily accomplished by anticoagulants. Particularly important as a prophylactic measure is the correction of anemia because the lower the cell volume, the greater the retractility of the clot.

The management of these patients requires the utmost cooperation between the laboratory, surgical, and medical services. Many drugs and operations have been used in combating this disease. The best treatment is prevention. Modern developments in the care of the patient such as the relief of gastric and intestinal distention by decompression, avoidance of operative trauma, better positioning of the patient on the operating table, correction of fluid balance, avoidance of poor positions (i. e., Fowler's) in bed, and correction of anemic conditions have prevented the formation of thrombi in many patients *(8)*. The treatment of predisposing cardiac diseases (with attention to the fact that the use of digitalis may favor thrombosis); the correction of obesity; and early ambulation help to prevent stasis with subsequent thrombosis and embolism.

Patients sent to this hospital with a diagnosis of thrombophlebitis were usually admitted on the medical service where rest in bed and antibiotics were first used. If the patient did not improve promptly, heparin was given in doses of from 100 to 200 mg. intravenously every 6 hr., with twice daily checks on bleeding and clotting time. Dicumarol, although much less expensive than heparin, has been used very little because of difficulty in controlling the results and inability to get consistently accurate prothrombin readings.

If the patient dislodged an embolus, an emergency surgical consultation was requested. If ligation of the superficial femoral

(8) Ayers, W. B.: Anticoagulant therapy in surgery. Bull. Tulane M. Fac. 9: 133, 1950.

vein was not enough to segregate the thrombus a vena cava ligation was recommended. This was not a disabling procedure in the 2 patients in this series on whom it was used as they are expected to return to full duty.

There is a wide divergence of opinion regarding the advantages of medical rather than surgical treatment. Anticoagulants apparently have reduced the incidence of thrombosis in some series. The danger of death from hemorrhage from anticoagulants is greater than that of death from embolism, according to Ayers *(8)*. It takes about 4 days for vitamin K to neutralize dicumarol. The following contraindications to the prophylactic use of anticoagulants have been established: (1) operations on the brain or spinal cord where even small hemorrhages can prove fatal; (2) ulcerative lesions, especially ulcerated tumors, which have a tendency to bleed (especially those of the gastrointestinal tract); (3) blood dyscrasias with a tendency to internal bleeding; (4) hepatic or renal insufficiency and diseases that may be accompanied by them such as, hyperthyroidism, diabetes, hypertension, and arteriosclerosis; (5) nutritional deficiencies with low levels of vitamin C and K; (6) thoracic operations where postoperative bleeding can be a serious problem; (7) excessive bleeding at operation; (8) prothrombin time of more than 25 seconds; (9) patients treated with aspirin, quinine, and probably also sulfonamides and neostigmine; and (10) inadequate laboratory facilities.

Ayers *(8)* used 10 cc. of a 10 percent solution of sodium thiosulfate intravenously 3 days before, and from 4 to 10 days after the fourth postoperative day if thrombosis is suspected, but not if the diagnosis has been established. Cameron *(9)* recommended alpha-tocopherol (vitamin E). It is of value for old patients with chronic ulcers but must be given for a long time. Its advantages are that it is cheap, is not dangerous, may be taken by the patient at home, and eliminates the use of stockings and bandages.

Carpenter and Dibble *(10)*, in favoring ligation over medical treatment, stated that because it is usually not the frankly thrombosed vein that is the source of the pulmonary embolus but its apparently more normal fellow, it is wise if ligation is performed to ligate both superficial femoral veins. Szilagyi and Alsop *(11)* also advocated the ligation of the femoral veins.

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(9) Cameron, W. R.: Alpha-tocopherol in management of acute and subacute venous thrombosis and thrombophlebitis. Shute Foundation for Medical Research. Summary 1950. 2: 29.

(10) Carpenter, W. S., and Dibble, H. F.: Ligation of inferior vena cava for acute femoro-iliac thrombophlebitis; case report. Harper Hosp. Bull. 6: 85-88, May-June 1948.

(11) Szilagyi, D. E., and Alsop, J. F.: Early and late sequelae of therapeutic vein ligation for thrombosis of veins of lower limbs. Arch. Surg. 59: 633-666, Sept. 1949.

They said that interruption of the vein does much to prevent the embolic complications of thrombosis provided (1) the operative indications are correct, (2) the level of the ligation is high enough, and (3) the operation is bilateral.

Thebaut and Ward *(12)* advocated vena cava ligation over all others because a single operation protects not only from emboli arising in both extremities but also from those arising in the pelvis. They preferred the extraperitoneal approach because it is simpler and lumbar sympathectomy can be performed, if desired, at the same time. The intestinal obstruction which occurred in 1 of the patients here reported could have been avoided by this approach. Also there is less likelihood of ileus and less danger of injuring the mesenteric vessels if the root of the mesentery is low. Shea *(13)* found in a study of the sequelas of inferior vena cava ligation that they were sufficiently disabling to make this justifiable only as a lifesaving procedure for the very ill patient with infarction after other means have failed. It should never be used for prophylaxis.

Wright *(14)* listed the requirements for a satisfactory anticoagulant drug. It should be cheap, quickly acting, nontoxic, and noncummulative, have a readily available nontoxic antagonist, and it should be easy to test its action.

Yahr et al. *(15)* have observed that blood coagulates more quickly in pregnant women because of an increase in fibrinogen. There is danger in the use of anticoagulants as the patient may abort and the obstetrician may have difficulty controlling the bleeding.

CASE REPORTS

Case 1. A 26-year-old white woman was admitted to the hospital with the diagnosis of thrombophlebitis of the left leg. She had struck her leg just above the ankle 10 days earlier. It seemed only a minimal trauma, but the pain had increased and was aggravated by walking. Examination showed a positive Homan's sign, tenderness in the calf muscles and popliteal space. Her temperature was 99.4° F. Her pulse was 100. Her sedimentation rate was 20. Her leukocyte count was 13,000 with 71 percent neutrophils. Her bleeding time was 3½ minutes. Her clotting time was 4½ minutes. Her hemoglobin was 86 percent. She was given 100,000 units of penicillin every 3 hr. and 30

(12) Thebaut, B. R., and Ward, C. S.: Ligation of inferior vena cava in thromboembolism; report of 36 cases. Surg., Gynec. & Obst. 84: 385-401, Apr. 1947.

(13) Shea, P. S., Jr.: Late sequelae of inferior vena cava ligation. Surg., Gynec. & Obst. 93: 153-158, Aug. 1951.

(14) Wright, I. S.: Use of anticoagulants in treatment of diseases of heart and vessels. Ann. Int. Med. 30: 80-91, Jan. 1949.

(15) Yahr, M. D.; Reich, C.; and Eggers, C.: Treatment of thrombophlebitis. Surg., Gynec. & Obst. 80: 615-619, June 1945.

cc. of whisky t. i. d. She developed a severe urticarial reaction to penicillin and this was discontinued and benadryl given. The pain continued in her left calf, which was 1 inch smaller in diameter than the right. Her left thigh was ½ inch larger in diameter than the right. Priscoline was given after the rash subsided, but she obtained no benefit from it although it was pushed to tolerance.

After 45 days of treatment with no improvement she was returned to the United States. Her sedimentation rate remained high and she continued to run a low fever. Three years previously she was hospitalized for the same condition following a similar minor injury. This may have caused the atrophy of the calf muscle in the left leg.

It seems reasonable to conclude that this woman had some predisposing cause to thrombophlebitis having developed it twice from minor injuries.

Case 2. A white man, age 22 years, was admitted to the hospital on 3 March 1952 complaining of pain in the left thigh and behind the knee of 24 hours' duration. He had had chills and fever in the evening preceding admission. The pain had extended upward to his left inguinal region and left lower abdominal quadrant. Physical examination was negative except for increased warmth in his left thigh. Both thighs were of the same diameter. There was tenderness and some rigidity but no rebound tenderness in the left lower abdominal quadrant. His inguinal region was also tender and contained an enlarged tender lymph gland. Pain was elicited by flexion or abduction of his hip. There was tenderness in his left popliteal region. Homan's sign was not present and his calf was not tender. His leukocyte count was 8,840 with 57 percent neutrophils. He was given 100 mg. of heparin 5 times daily. Penicillin was also given. The heparin increased his coagulation time to 90 minutes, so the dose was cut in half and the coagulation time dropped to 15 minutes. He was maintained on this dose for 10 days and his coagulation time fell to 7 minutes. Because he developed urticaria, the penicillin was discontinued and aureomycin, which he tolerated well, was given. On 21 March he was discharged to duty.

This appeared to be a spontaneous iliofemoral thrombophlebitis which cleared completely on antibiotics and anticoagulants. Because of the chills and fever at the onset, it was considered to be on an infective basis. McLachlin and Paterson *(5)* emphasized the need for a Homan's sign in the upper thigh as a test for femoral thrombophlebitis.

Case 3. A 27-year-old white woman was admitted to the hospital on 27 September 1951 with a dermatophytosis of both feet. Her left foot was swollen on the day before admission and she had had small blisters with pruritus on both feet for 1 week.

She had had an appendectomy and ovarian cyst removed in 1949. A sacral sympathectomy for menstrual pain was performed at the same time. She had been taking thyroid tablets for menstrual difficulty. Physical examination was negative except for blisters on both feet, and her left foot was diffusely swollen and warm. Her right axillary and left inguinal lymph nodes were enlarged and tender. During the course of several months in the tropics she had had intermittent fungus infections of the feet.

Four days after admission she developed a tender and painful left calf, and a positive Homan's sign. She was given 100 mg. of heparin every 6 hr. for 6 days with no improvement. While in the hospital the fungus infection cleared and recurred several times at 3-day intervals, but at each recurrence seemed worse. She was on complete bed rest, antibiotics, and local treatment. Her temperature averaged around 99.6° F. Her leukocyte count was 15,200 with 72 percent neutrophils. Her bleeding time was from 3 to 8 minutes.

Her leg continued to be swollen and tender. No embolic phenomenon was present. Her deep calf veins and long saphenous veins were involved. One antibiotic after another was used, but after 5 weeks' treatment there was no improvement. She was sent back to the United States where a lumbar sympathectomy was performed with very little improvement. What effect her previous sacral sympathectomy had is unknown, but the pooling of blood in the dilated iliac veins may have played a part. Six months later she was still having pain and swelling in the leg.

Case 4. A white man was admitted to the medical service on 4 December 1951 with a diagnosis of pneumonia. His chief complaint was sudden pain in his chest with hemoptysis. A roentgenogram showed a peripleural density of his right lower lobe. His leukocyte count was 9,700 with 79 percent neutrophils. His sedimentation rate was 24. His hemoglobin was 13.5.

On further questioning, he said he had had a "charley horse" in the right calf a week before admission. It had come on spontaneously. Physical examination showed a positive Homan's sign and deep calf and popliteal tenderness. It was postulated that the "pneumonia" was really a pulmonary infarct. He was given heparin and dicumarol until 17 December. His prothrombin time then was 27 seconds and his prothrombin 32 percent. He

had another severe pain in his chest and there was evidence of pathology in the right leg. As this was the second embolus it was decided to ligate the vena cava. The abdomen was entered through a low right rectus incision. The vena cava and its abdominal branches were free from thrombi. The vena cava was exposed just above its bifurcation. It was doubly ligated and the posterior peritoneum closed. Because the appendix was attached in such a way that the blood supply of its mesentery was imperiled, it was removed.

The convalescence was uneventful for the first 4 days. The legs had good color and warmth. On the fifth day, the patient began to have abdominal distention. He was intubated and an enema was given. This gave him some relief. On the seventh postoperative day he had borborygmus, distention, and periodic abdominal pain. A roentgenogram showed gas and fluid levels in the small intestine.

The old right rectus incision was reopened through the peritoneum as just prior to this, a total separation of the wound had occurred down to the peritoneum. The peritoneal cavity was filled with a brownish, serosanguineous fluid. Distended loops of bowel were located and traced down to the terminal ileum where a band of adhesions which passed from the omentum to the appendiceal stump on the cecum was found. The stump was intact. The omentum was freed and a bandlike area of constriction was noted at the point of obstruction. This point was located about 10 cm. from the ileocecal valve. A rent in the ileal mesentery and a hole in the omentum where it has been adherent to the incision were repaired with No. 00 chromic catgut. Both iliac veins and the vena cava had a firm, hard clot up to the point of ligation. The sacral veins were distended. The wound was closed in one layer with medium wire.

The patient was ambulatory in 2 days. The sutures were removed in 10 days. Elastic bandages up to the groin were worn during ambulation. Edema was minimal after he was up all day. He was evacuated to the United States.

In this patient the phlebothrombosis came on spontaneously in a previously healthy man. The cause is unknown. His pleural pain subsided immediately after the ligation.

Case 5. A white man, age 20, was admitted on 19 September 1951 complaining of enuresis of several months' duration. He had pus in his urine and prostatic secretion. He had had several prostatic massages which failed to reveal any cause. An intravenous pyelogram was negative. A circumcision was performed on 7 October because his redundant prepuce was thought to be contributory to his enuresis. On 19 October, 1 month after treatment began, he went 7 days without enuresis. On 13 November

he complained of pain in the right flank and right lumbar region. On 15 November he had nausea and vomiting and on 17 November, after fluids had been given intravenously for 3 days, his urine was very dark but negative for bile and porphyrin. His leukocyte count at this time was 7,350. On 19 November his temperature rose to 102° F. and he developed severe pain and extreme tenderness in the right lower abdominal quadrant, with the same symptoms (but milder) on his left side. His urinary output for 24 hours was 160 cc. His leukocyte count rose to 23,000. Homan's sign was negative. There was tenderness over his deep calf muscles, the upper portion of his thigh, and his inguinal region. His right thigh was 1 inch larger in diameter than the left.

On 21 November, because it was thought that there was a lesion obstructing the venous return, an exploratory operation was performed through a low right rectus incision under spinal anesthesia. The abdomen was explored and no obvious cause for his symptoms was found. His abdominal wall, appendix, and cecum were edematous. There was a diffuse enlargement on each side of his pelvic brim. On deflecting the peritoneum, these masses were found to be thrombosed iliac veins. The dissection was carried up to the inferior vena cava which was thrombosed up as far as the pancreas and perhaps further. The vena cava seemed to be the site of an inflammatory process. Taking one at a time, each iliac vein was freed and ligatures were placed around its proximal end, but not tied, and a longitudinal incision was made in the vena cava. A large clot was aspirated but there was free flow of blood. A catheter was inserted up to the diaphragm and further aspiration made. Two ounces of saline solution were injected and the vein was ligated with No. 4 silk. The abdomen was closed without a drain.

On the patient's return to the ward, 200 mg. of heparin was given intravenously at once; 300 mg. of dicumarol was given orally; and a transfusion of 500 cc. of whole blood was given. Two hours later, the transfusion was repeated and 100 mg. of heparin was given. Heparin and dicumarol were given on the next day and he appeared somewhat more comfortable. Because his abdomen was distended, a Levin tube was inserted and suction begun. His urine remained dark amber and scanty. His temperature continued to be elevated. On 23 November his condition remained essentially the same. He denied having pain in the legs. He had no abdominal pain but his abdomen remained distended. He passed more urine which was slightly less amber. He was given 100 mg. of heparin 4 times a day. He also received dicumarol. His nonprotein nitrogen was 60 mg. per 100 cc.

The patient improved and by 27 November the dose of heparin had been reduced to 100 mg. daily; the Levin tube was removed; and peristalsis became active. Ambulation was started on 1

December. Leg exercises were taught and became a daily routine. Elastic bandages extending to the thighs were worn whenever the patient was out of bed. He was subsequently evacuated to the United States.

This patient's disease undoubtedly had an infectious basis, but whether from the prostatitis, the instrumentation, or the massage is unknown. It seems hardly likely that the circumcision was a contributory cause. One feature of this case which Barron *(16)* emphasized was that the patient had a feeling of apprehension and a sense of impending disaster as an early symptom.

Case 6. A 59-year-old man was admitted on 13 April 1951 with jaundice, epigastric distress, and abdominal pain. He had 2 positive Kahn tests and an elevated sedimentation rate. A diagnosis of obstructive jaundice was made and he was given a course of penicillin before operation. On 1 May his gallbladder was removed and several stones were evacuated from his common duct. A catheter was easily passed into his duodenum and a T-tube was placed in his common duct.

His convalescence was stormy with a great deal of vomiting and periodic attacks of hiccup. A cholangiogram made on 21 May showed a small stone at the ampulla of Vater. Several attempts to remove the stone by irrigation with procaine solution were made without avail. His blood chemistry remained essentially normal as a result of repeated transfusions and proteins given intravenously. On 22 May a second operation was performed and the small stone was removed with difficulty from the common duct. On the following day he developed symptoms of shock, pain in the chest, rapid pulse, and died 1 hour later.

Autopsy revealed a massive pulmonary embolism which arose from thrombosis in the femoral veins. At no time did he have any symptoms of thrombophlebitis and Homan's sign was repeatedly negative.

CONCLUSIONS

Thrombophlebitis and phlebothrombosis are relatively uncommon in the tropics. Some unknown factor or combination of factors are yet to be found to explain this.

Certain persons are more prone to have intravenous clotting than others as shown by the large number of recurrences.

The ideal anticoagulant has not been found.

The treatment of these patients should be medical in the beginning, using antibiotics and anticoagulants unless the initial symptom is pulmonary embolism. In this case ligation should be performed at once.

(16) Barron, J.: Measures to prevent complications of phlebothrombosis by early diagnosis. Indust. Med. 18: 422-425, Oct. 1949.

Bilateral ligation of the superficial femoral veins is the operation of choice. If this is not high enough to be proximal to the clot, ligation of the vena cava is indicated. In all cases of ligation, it is well to open the vein and aspirate the thrombus if possible. In one of my patients this was essential because the thrombus extended above the openings of the renal veins into the vena cava.

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Textbook of General Surgery, by *Warren H. Cole,* M. D., F. A. C. S., Professor and Head of the Department of Surgery, University of Illinois College of Medicine; Chief Surgeon, Illinois Research and Educational Hospitals, Chicago, and *Robert Elman,* M. D., F. A. C. S., Professor of Clinical Surgery, Washington University School of Medicine; Assistant Surgeon, Barnes Hospital; Associate Surgeon, St. Louis Children's Hospital; Chief of Staff and Director of Surgical Service, H. G. Philips Hospital, St. Louis. Foreword by *Evarts A. Graham,* M. D., F. A. C. S. 6th edition. 1,154 pages; illustrated. Appleton-Century-Crofts, Inc., New York City, N. Y., publishers, 1952.

Essentials of Dermatology, by *Norman Tobias,* M. D., Associate Clinical Professor of Dermatology, St. Louis University; Assistant Dermatologist, Firmin Desloge and St. Mary's Hospitals; Visiting Dermatologist, St. Louis State Hospital; Fellow, American Academy of Dermatology and Syphilology; Diplomate, American Board of Dermatology and Syphilology; Visiting Physician in the Department of Dermatology at the St. Louis City Hospital. 4th edition. 596 pages; illustrated. J. B. Lippincott Co., Philadelphia, Pa., publisher, 1952.

Viral and Rickettsial Infections of Man, edited by *Thomas M. Rivers,* M. D., Director of the Hospital, The Rockefeller Institute for Medical Research. 2d edition. 719 pages; illustrated. J. B. Lippincott Co., Philadelphia, Pa., publisher, 1952.

Korea, 1950. *Office of the Chief of Military History, Department of the Army,* 281 pages; illustrated. Government Printing Office, Washington, D. C., publisher, 1952. Price $1.25.

Rare Manifestations of Metabolic Bone Disease, Their Practical Importance, by *I. Snapper,* M. D., Ph. D., Physician and Director of Medical Education, Mount Sinai Hospital; Clinical Professor of Medicine, Columbia University College of Physicians and Surgeons, New York, N. Y. 29th Annual Beaumont Lecture, Delivered before the Wayne County Medical Society, February 6, 1950. 96 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1952. Price $3.

Clinical Progress in Cardiovascular Disease, edited by *Herrman L. Blumgart,* M. D., Physician-in-Chief, Beth Israel Hospital, and Professor of Medicine, Harvard Medical School, Boston, Mass. Modern Medical Monographs, No. 2. 143 pages; illustrated. Grune & Stratton, Inc., New York, N. Y., publishers, 1952. Price $4.50.

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Diseases of the Chest, by *T. Royle Dauber,* A. B., M. D., F. A. C. P., Senior Surgeon, U. S. P. H. S.; Chief of Heart Disease Epidemiology Study, National Heart Institute; Assistant in Medicine, Harvard Medical School, and *Lloyd E. Hawes,* A. B., M. D., D. A. B. R., Radiologist at Faulkner Hospital; Consultant at U. S. P. H. S. Hospital, Boston. 440 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1952. Price $10.

Problems of Aging, Transactions of the Fourteenth Conference, September 7-8, 1951. St. Louis, Mo., edited by *Nathan W. Shock,* Chief, Section on Gerontology, National Heart Institute, National Institutes of Health and the Baltimore City Hospitals, Baltimore, Md. Sponsored by the Josiah Macy, Jr. Foundation. 138 pages; illustrated. Printed by Progress Associates, Inc., Caldwell, N. J., 1952. Price $3.

The Pathogenesis and Treatment of Thrombosis, With a Clinical and Laboratory Guide to Anticoagulant Therapy, by *Irving S. Wright,* M. D., Professor of Clinical Medicine, Cornell University Medical College, New York. Modern Medical Monographs, No. 1. 78 pages; illustrated. Grune & Stratton, Inc., New York, N. Y., publishers, 1952. Price $3.

Viruses as Causative Agents in Cancer, by *C. P. Rhoads* (Conference Chairman), *H. B. Andervont, W. G. Banfield, F. B. Bang, L. M. Black, H. Blank, W. L. Bostick, A. C. Braun, H. Bunting, B. R. Burmester, A. Cantarow, S. S. Cohen, L. Dmochowski, F. Duran-Reynals, E. A. Evans, Jr., W. H. Gaylord, A. E. Gessler, D. R. Ginder, E. D. Goldsmith, S. Graff, L. Gross, C. D. Haagensen, M. Heidelberger, A. D. Hershey, F. L. Horsfall, Jr., F. L. Kallman, A. G. Karlson, H. Koprowski, B. Lucké, F. C. Mann, K. S. McCarty, J. L. Melnick, A. E. Moore, R. F. Nigrelli, K. E. Paschkis, R. D. Passey, H. Pinkerton, K. R. Porter, S. M. Rose, A. B. Sabin, R. W. Schlesinger, M. H. D. Smith, J. Stasney, M. J. Strauss,* and *J. T. Syverton.* Editor: *Roy Waldo Miner.* Consulting Editor: *C. P. Rhoads.* Annals of the New York Academy of Sciences, Volume 54, Art. 6, pages 869-1232. 363 pages; illustrated. New York Academy of Sciences, New York, N. Y., publisher, 1952. Price $4.

Battle Casualties, Incidence, Mortality, and Logistic Considerations, by *Gilbert W. Beebe,* Ph. D., Division of Medical Sciences National Research Council; Formerly Captain, Medical Administrative Corps, A. U. S. and *Michael E. DeBakey,* M. D., Professor of Surgery, Baylor University College of Medicine: Formerly Colonel, Medical Corps, A. U. S. 277 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1952. Price $10.50.

Progress in Neurology and Psychiatry, Volume VII, An Annual Review, edited by *E. A. Spiegel,* M. D., Professor and Head of the Department of Experimental Neurology, Temple University School of Medicine, Philadelphia, Pa., 604 pages. Grune & Stratton, Inc., New York, N. Y., publishers, 1952. Price $10.

The Clinical Application of Antibiotics, Penicillin, by *M. E. Florey,* M. D., From the Sir William Dunn School of Pathology, Oxford. This volume, although a separate publication, is a continuation of the work described in **Antibiotics,** Volumes I and II, and may be read in conjunction with it. 730 pages; illustrated. Oxford University Press, New York, N. Y., publisher, 1952.

RESTORATION OF THE JAW[1]

BERNARD N. SODERBERG, *Colonel, MC, U. S. A.* (2)
HAL B. JENNINGS, Jr., *Lieutenant Colonel, MC, U. S. A.* (2)
JUSTIN E. McNELLY, *Lieutenant Colonel, DC, U. S. A.* (3)

THE problem of traumatic jaw repair becomes especially important in wartime. The jaw lesions now seen in casualties from Korea are comparable to those that have occurred in other conflicts. These lesions involve not only the cutaneous elements of the features, but also the underlying muscle and bone. The following case illustrates the successive operative stages used in the repair of a compound jaw injury.

CASE REPORT

A 30-year-old man sustained an avulsive wound of the jaw when shell fragments destroyed the soft tissues of his chin, the floor of his mouth, and most of his mandible (fig. 1). The remaining structures consisted of a transverse section of lower lip, the tongue, and the bony ramus and angle of the lower jaw. The repair was designed to progress through 3 stages. The first, accomlished by using transplantable tissue from elsewhere, consisted of soft tissue reconstruction (fig. 2). A tube pedicle (fig. 3) was constructed on the chest wall. It was of sufficient size and length not only to reach the recipient position, but also to provide adequate tissue for the bone graft bed. In the second stage the jaw bone was repaired by using a tantalum tray support connecting the fragment of the left angle of the mandible to that of the right (fig. 4) (4). This tray was shaped and perforated with multiple small holes prior to operation to allow better tissue approximation to the graft. At the operation, it was necessary only to wire the tray in place and pack cancellous bone from the ilium on top (fig. 5). These large sections of bone were attached to the tray by circumferential wires (fig. 6). Cracks and crevices between the blocks of bone were packed with bone chips. The soft-tissue tube transplant and adjacent cheek closed adequately over the transplant.

When the tantalum tray was removed, multiple tissue attachments to the bone graft through all the perforations were ob-

(1) Presented at Post Graduate Surgical Conference, Brooke Army Hospital, Fort Sam Houston, Tex., November 1951.

(2) Brooke Army Hospital, Fort Sam Houston, Tex.

(3) Resident, Oral Surgery Service, Episcopal Hospital, Philadelphia, Pa.

(4) Blocker, T. G., Jr., and Weiss, L. R.: Use of cancellous bone in repair of defects about jaws. Ann. Surg. 123: 622-638, Apr. 1946.

Figure 1. Photograph showing defect of the lower jaw. *Figure 2. Soft-tissue reconstruction completed.*

Figure 3 Diagram showing (A) origin and (B) final placement of tube pedicle.

Figure 4 Roentgenogram showing tantalum tray supporting cancellous bone graft from the ilium.

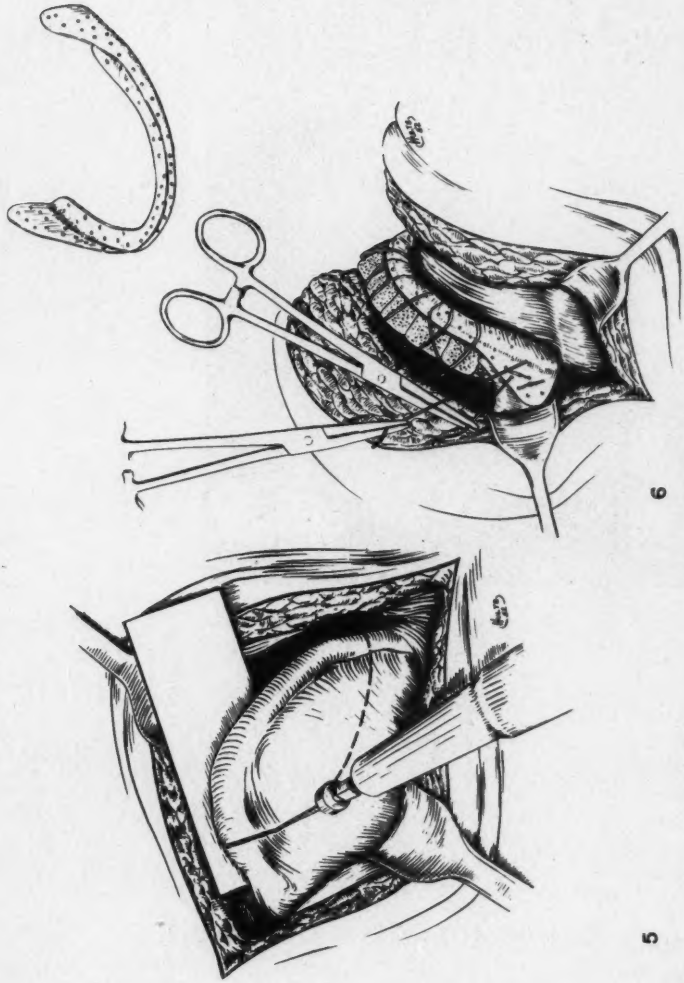

Figure 5. Diagram of bone graft removed from the ilium. Figure 6. Diagram showing fixation of tantalum plate supporting bone graft to angle of mandible.

served (fig. 7). All grafts were decorticated. In this case, the tantalum tray remained in place for 1 year. The third stage dealt with intraoral soft-tissue revision and skin grafting. The object at this time was sulcus construction. This was necessary for the denture site. Intraoral incisions were made lateral to the bone graft. They were located as close to the bone as possible, allowing only for minimal soft-tissue coverage over the graft. Skin grafts thus closely approximated reduce shrinkage

Figure 7. Roentgenogram taken after the tray was removed showing adequate bone graft to support denture.

and result in a better base for the denture. The incision was carried deeply as well to allow for some depth loss through contraction. The free graft, obtained from a nonhairy body area, was draped over a form-fitting stent constructed from dental compound. The stent was fixed firmly in place and remained immovable for 10 days, after which it was replaced by an acrylic form of the same size. Retention of this distender for 3 months also helped overcome postoperative skin-graft contraction. The constructed sulcus permitted the wearing of dentures.

DISCUSSION

Various ways have been devised to repair soft-tissue defects of the jaw. Results are similarly good when adequate tissue has been supplied. Overcorrection may be desirable to allow for subsequent shrinkage. Soft-tissue transplants should be obtained from a part of the body having sufficient subcutaneous thickness. Because of physical variations, a transplant may come from the chest, arm, or abdomen. In obese patients, the latter may be

undesirable because tubes with excessive amounts of subcutaneous fat are difficult to transplant successfully. The excess volume is unnecessary. The large bulk also may be so heavy that holding the transplant in place becomes a problem. Transplants from the chest have been used in most cases. Repairs by transverse neck and arm tubes have been unsuccessful because the skin and subcutaneous tissue have been too thin. The transplant can be in the form of a flap or tube. In the former, skin dressing for the raw surface makes a cleaner wound and saves handling time and postoperative dressings. We prefer tubes because they offer a closed unit with migratory features more adaptable to a variety of situations *(5)*. In our hands, the time factor is the same for either the flap or tube transplant. The tantalum support for the hip graft has been a successful procedure in all cases. We have modified this support for small defects, and it has been satisfactory in partial body losses. The posterior plate attachment holds the angle fragment well down in place. We have now largely discarded the external traction for preoperative fragment positioning. The angle fragment is removed from its cocked-up position at the time of the bone-grafting operation. The repositioning of the angle is accomplished by periosteal stripping on all sides. Difficulties in mobilization occur when medial spicules of bone are present. If such a spicule is discovered, it can usually be removed with ease. The size of the tantalum support can be predetermined by model studies and roentgenographic measurement. Tantalum trays were originally shaped by swaging the metal and using a die and counterdie. Although tantalum has a high melting point, it crystallizes at comparatively low temperatures. This method of tray construction along with the necessary hole drilling tends to cause some crystallization of the metal by the heat produced. Such a tray has an inherent weakness. We have found, therefore, that it is simpler to cut the tray with shears in the desired shape and to bend the flange with pliers. This results in a stronger structure. A punch press is used to perforate the trays. The holes are made in parallel lines so that the tray may be trimmed at the time of operation by cutting between the holes, thereby maintaining a smooth edge. Some of our trays have broken during the postoperative period. We believe that this has been largely due to improper handling of the metal in the construction of the tray, causing it to become brittle and weak. Intraoral splint fixation is important when teeth are present in the posterior fragment of the mandible, as in the case presented. The ramus may be positioned and immobilized by means of wire loops about the teeth and intermaxillary elastic traction. This method helps prevent upward and backward displacement and lateral deviation of the ramus.

(5) Soderberg, B. N., and Mulvey, J. M.: Mandibular reconstruction in jaw deformities. J. Plast. & Reconstruct. Surg. 2: 191-206, May 1947.

The ramus fragments should be carefully studied. The tooth areas should be checked for abscesses or caries as well as for their position in relation to the fragment end. Exposure of a tooth at operation while preparing the area for bone grafting may doom the graft to failure. An acute abscess of a tooth occurring postoperatively with subsequent spread of infection can cause loss of the bone graft.

Several methods of intraoral skin-graft transplantation are available *(5)*. The onlay graft procedure is the one most frequently used. If sufficient teeth are present, an intraoral splint can be constructed so that the dental compound molded to the recipient site can be fixed to it. This is valuable because the acrylic distender can be held by the same device. The alternative method is to hold the stent in place by sutures. These, peripherally placed, unite over the summit of the stent, fixing its position. If this procedure is followed, provision must be made to hold the distender for several months after the graft takes to overcome graft contraction. The tube pedicle for intraoral repairs is confined largely to upper jaw defects *(6)*.

(6) Soderberg, B. N.: Surgical repairs of facial injuries. J. Plast & Reconstruct. Surg. 8: 208-221, Sept. 1951.

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Circulatory Dynamics, Physiologic Studies, by *Carl J. Wiggers,* M. D., Sc. D., F. A. C. P., Professor of Physiology and Director, Department of Physiology, School of Medicine, Western Reserve University, Cleveland, Ohio. Modern Medical Monographs, No. 4, 107 pages; illustrated. Grune & Stratton, Inc., New York, N. Y., publishers, 1952. Price $4.

Massage and Remedial Exercises in Medical and Surgical Conditions, by *Noël M. Tidy,* Member of the Chartered Society of Physiotherapy; T. M. M. G. 9th edition. 519 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1952. Price $6.

Living With Diabetes, by *Edward Tolstoi,* M. D. 90 pages. Crown Publishers, Inc., New York, N. Y., 1952. Price $2.

BOOK REVIEWS

Psychiatry and Medical Education, Report of the 1951 Conference on Psychiatric Education held at Comell University, Ithaca, N. Y., June 21-27, 1951. Organized and conducted by the American Psychiatric Association and the Association of American Medical Colleges. Editorial Board: John C. Whitehorn, M. D. (Chairman); Carlyle Jacobsen, Ph. D.; Maurice Levine, M. D.; and Vernon W. Lippard, M. D. Editorial Assistants: Stella Bloch Hanau and Robert L. Robinson. 164 pages. American Psychiatric Association, Washington, D. C., publisher, 1952.

In this report special reference to the delineation of the present role of psychiatry in medical schools is made. It is well written and would be of interest to all who are directly or indirectly connected with the field of medical education.

—Lt. Col. H. E. Wilkinson, MC, U. S. A.

Diseases of the Nervous System, Described for Practitioners and Students, by *F. M. R. Walshe,* M. D., D. Sc., F. R. S., Fellow of the Royal College of Physicians of London; Fellow of University College, London; Consulting Physician to University College Hospital, and to the National Hospital for Nervous Diseases, Queen Square. 7th edition. 365 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publisher, 1952. Price $5.50.

The first edition of this textbook of neurology was published in 1940. The author has written this book for the use of medical students and general practitioners in order to describe for them the more common neurologic conditions. In the present edition, the material has been revised and condensed in order to give a concise and clear delineation of the more common diseases of the nervous system. The fact that 7 editions have been published in 12 years indicates the worth of this book. The author has purposely omitted controversial subjects, a description of rare conditions and of the more refined and esoteric neurologic procedures. This has added to the value of the book, which is not intended to be a reference and it is not dedicated to the practicing neurologist. The only criticism which can be directed toward it concerns the inclusion of the chapter on psychoneuroses at the end. The author apologizes for its inclusion, but that does not obviate the fact that such a subject has no place in such a textbook. Inasmuch as it is impossible to treat the subject either adequately or well, the value of the book would be enhanced by its deletion.

—Commander H. S. Colony, MC, U. S. N.

STEVENS-JOHNSON SYNDROME[1]

WILLIAM R. HAAS, *Colonel, U. S. A. F. (MC)*
AARON BIRENBAUM, *Captain, U. S. A. F. (MC)*
CHESTER E. KAMINESTER, *Captain, U. S. A. F. (MC)*

IN the last 2 years there has been an increasing number of isolated case reports dealing with the Stevens-Johnson syndrome. Although many authors have mentioned the relative rarity of this syndrome, we believe that this disease occurs more frequently than is usually thought and is often incorrectly diagnosed because of the complexity of symptoms and the great variance in current terminology. This syndrome has been described under such names as erythema multiforme exudativum, Hebra's disease, eruptive fever with stomatitis and ophthalmia, ectodermosis erosiva pluriorificialis, erythema iris conjunctivae, mucosal respiratory syndrome, Stevens-Johnson syndrome, and erythema multiforme bullosum. This leads to confusion and unfamiliarity with the syndrome. The term Stevens-Johnson syndrome has been used more and more frequently and it is suggested, for no other reason than to avoid further confusion, that this term be adopted to describe this clinical entity.

In 1808, Willan and Bateman first described the erythemas; and in 1822, Alibert and Bazin reported an erythema-like skin rash with conjunctivitis and stomatitis. In 1866, Hebra defined a clinical entity consisting of fever, systemic signs, and cutaneous lesions to which he gave the name of erythema multiforme exudativum. In 1922, Stevens and Johnson (2) described what appeared to be a new clinical entity and reported 2 patients diagnosed as having eruptive fever with stomatitis and ophthalmia. Their findings differed little from those of previous investigators. More recently, Keil (3), Fletcher and Harris (4), and Soll (5) have presented excellent reviews of the syndrome.

CLINICAL FEATURES

The condition is an acute, self-limited, febrile disease characterized by lesions of the skin and mucous membranes. In most cases, the

(1) U. S. Air Force Hospital, Scott Air Force Base, Ill.

(2) Stevens, A. M., and Johnson, F. C.: New eruptive fever associated with stomatitis and ophthalmia. Am. J. Dis. Child. 24: 526-533, Dec. 1922.

(3) Keil, H.: Erythema multiforme exudativum (Hebra); clinical entity associated with systemic features. Ann. Int. Med. 14: 449-494, Sept. 1940.

(4) Fletcher, M. W. C., and Harris, R. C.: Erythema exudativum multiforme (Hebra)—bullous type; cases seen in contagious disease hospital. J. Pediat. 27: 465-479, Nov. 1945.

(5) Soll, S. N.: Eruptive fever with involvement of respiratory tract, conjunctivitis, stomatitis and balanitis; acute clinical entity, probably of infectious origin; report of 20 cases and review of literature. Arch. Int. Med. 79: 475-500, May 1947.

illness begins with symptoms of an upper respiratory infection which varies in severity from moderate nasal congestion to a severe pharyngitis with fever and malaise. In a few days the oral manifestations become prominent and progress to an ulcerative stomatitis. Vesicles rapidly appear over the oral mucosa and involve the buccal surfaces, lips; palate, and tongue. The vesicles usually rupture within 24 hours to form multiple ulcerations which are covered with a friable pseudomembrane that bleeds easily. This membrane may form in the oropharynx and is difficult to differentiate from that of diphtheria. Such patients are uncomfortable, have marked dysphagia, severe pain on moving the tongue or opening the mouth, fissuring and bleeding of the lips, and secondary crust formation. Recovery usually begins within from 9 to 14 days. The pain and soreness in the mouth diminish and the pseudomembrane begins to disappear with the formation of new patches of mucous membrane *(5)*.

The ocular manifestations are characteristic of a conjunctivitis accompanied by a mucoid or purulent discharge. A pseudomembrane may form on the conjunctiva. The ocular involvement may be accompanied by severe complications such as: (1) perforation of the cornea and the appearance of panophthalmitis with total loss of vision; (2) corneal scarring with diminution of visual acuity; or (3) chronic conjunctivitis and the formation of symblepharon with subsequent distortion of the eyelids *(6)*.

Genital manifestations occur in a high percent of patients. They usually occur several days after the oral lesions have appeared and consist of urethritis, balanitis, or vaginitis. The severity may vary in males from slight redness about the urethral meatus to marked ulcerations on the glans penis with maceration of the skin *(5)*. The genital lesions usually subside without complications.

Skin lesions are also present in a high percent of patients. They usually appear as erythematopapular lesions or a vesiculobullous type of eruption. The bullas usually rupture and become encrusted, leaving an area of brown pigmentation which tends to fade slowly over a long period.

Involvement of the lower respiratory tract may be manifested by tracheobronchitis or pneumonitis. Finland et al. *(7)* reported 4 patients with pneumonia and the Stevens-Johnson syndrome in whom the psittacosis virus was found. The gastrointestinal tract may also be involved. Crawford and Luikart *(8)* described a patient with ulcers and pseudopolyps of the colon. Ulcers may also be present in the

(6) Wright, D. O.; Gold, E. M.; and Jennings, G.: Stevens-Johnson syndrome; report of 9 patients treated with sulfonamide drugs or penicillin. Arch. Int. Med. 79: 510-517, May 1947.

(7) Finland, M.; Jolliffe, L. S.; and Parker, F., Jr.: Pneumonia and erythema multiforme exudativum; report of 4 cases and 3 autopsies. Am. J. Med. 4: 473-492, Apr. 1948.

(8) Crawford, G. M., and Luikart, R. H., II: Severe erythema multiforme with intestinal involvement. J. A. M. A. 140: 780-781, July 2, 1949.

anal mucosa. Dresner *(9)* reported a patient with severe swelling of the joints. Because any of the mucous membranes in the body may be involved in this syndrome, the diagnosis is often difficult.

OCCURRENCE

The syndrome occurs in members of either sex but is more frequent in the male. It may occur at any age although Murphy *(10)* considered it to be "definitely in the pediatric sphere." Howard and Pedvis *(11)* treated a 1-year-old girl and Fishman *(12)* an 85-year-old woman for this disease.

ETIOLOGY

Though many have been suggested, the etiologic agent has not been definitely established. Among the suspected agents are:

1. *A virus.* Finland et al. *(7)* reported several patients with pneumonitis in whom high titers for the psittacosis virus were found. This finding has not been substantiated by other investigators. Givner and Ageloff *(13)*, Edgar and Syverton *(14)*, and Soll *(5)* have attempted to isolate a virus from vesicle fluid and the saliva without success.

2. *Bacteria.* Bacteriologic investigations have revealed nothing specific. Cultures from the conjunctival discharge and cutaneous lesions usually reveal secondary contamination with staphylococcus. Cultures from the oral lesions reveal a varied mixture of organisms consisting of staphylococcus, streptococcus, *Neisseria catarrhalis*, pneumococcus, and, occasionally, Vincent's organism. Blood cultures have been unrevealing.

3. *Allergy.* Drug sensitivity has been suggested as a cause of the disease because it has occurred following the use of sulfonamides. An allergic reaction to bacteria without an actual invasion of microorganisms has been suggested *(15)*.

PATHOLOGY

The essential finding in the skin is an acute inflammatory process in the epidermis characterized by edema, congestion, and hemorrhage.

(9) Dresner, E.: Erythema multiforme exudativum (Stevens-Johnson syndrome). Lancet 2: 1036-1038, Dec. 3, 1949.

(10) Murphy, R. C., Jr.: Eruptive fever involving mouth and eyes (Stevens-Johnson's disease); report of case. New England J. Med. 230: 69-71, Jan. 20, 1944.

(11) Howard, J. E. (Santiago, Chile), and Pedvis, S.: Severe erythema multiforme (Stevens-Johnson syndrome) in childhood. Am. J. Dis. Child. 75: 695-701, May 1948.

(12) Fishman, H. C.: Topical use of cortisone in erythema multiforme bullosum; report of case. California Med. 74: 392, May 1951.

(13) Givner, L., and Ageloff, H.: Stevens-Johnson disease with complete visual recovery. New York State J. Med. 41: 1762-1765, Sept. 1, 1941.

(14) Edgar, K. J., and Syverton, J. T.: Erythema exudativum multiforme with ophthalmia and stomatitis; report of 2 cases in children with certain observations on histopathology and animal inoculation. J. Pediat. 12: 151-159, Feb. 1938.

(15) Wentz, H. S., and Seiple, H. H.: Stevens-Johnson syndrome, variation of erythema multiforme exudativum (Hebra); report of 2 cases. Ann. Int. Med. 26: 277-283, Feb. 1947.

This is followed by round-cell infiltration and exudation of fluid that splits the cell layers and forms vesicles and bullas before sloughing. The bullous lesions are clinically and histologically identical with those of pemphigus, and the 2 diseases are differentiated only by their clinical courses *(16)*.

LABORATORY

The laboratory findings are nonspecific. The white blood cell count may be elevated but is usually within normal limits. There may or may not be an eosinophilia.

DIFFERENTIAL DIAGNOSIS

The Stevens-Johnson syndrome must be differentiated from several diseases. It is characterized by squamous and modified squamous epithelium, producing inflammation and erythema which form vesicles, bullas, and pseudomembranes. The skin involvement is a form of erythema multiforme which follows a definite pattern of circumscribed, bilaterally symmetrical maculopapular erythema and progresses to fluid formation. It regresses through crusting and produces a brown pigmentation. The mucosal lesions go through a cycle similar to that of the cutaneous lesions except for the lack of residual pigmentation.

The toxic erythemas may sometimes be confusing because a history of drug ingestion may be elicited. The lesions tend to become confluent, but often remain macular and are associated with urticaria. There is usually only a mild systemic reaction as compared to that seen in this syndrome. There are usually no prodromal respiratory symptoms.

The Stevens-Johnson syndrome is easily differentiated from severe rubeola, varicella, vitamin deficiency, and the human form of foot-and-mouth disease. All of these conditions present characteristic clinical findings and, in the latter, a specific virus can be demonstrated. Pemphigus may cause some difficulty in diagnosis but it is a chronic disease of older age groups and is noted for its dirty, oozing, cutaneous lesions and prolonged clinical course. Reiter's syndrome is characterized by conjunctivitis, arthritis, and urethritis but no cutaneous manifestations. Diphtheria, especially the cutaneous type, may be difficult to differentiate clinically from this syndrome. The culture of *Corynebacterium diphtheriae* from the throat or the cutaneous lesions is diagnostic.

A disease first described in 1944 by Buddingh and Dodd *(17)* must also be differentiated. It affects infants and young children chiefly and is characterized by involvement of the lips, tongue, and gums

(16) McCarthy, L.: Histopathology of Skin Diseases. C. V. Mosby Co., St. Louis, Mo., 1951.

(17) Buddingh, G. J., and Dodd, K.: Stomatitis and diarrhea of infants caused by hitherto unrecognized virus. J. Pediat. 25: 105-113, Aug. 1944.

with tiny vesicles which later desquamate and leave raw surfaces. There is usually an associated diarrhea. It is highly contagious, and a virus has been isolated from its lesions.

TREATMENT

Treatment of this disease is difficult to evaluate because of its self-limiting course. Probably all of the known antibiotics have been tried in the treatment of this condition. The sulfonamides have been used with supposedly good results *(6,18)* even though there are numerous case reports suggesting them as possible causative agents. The effect of penicillin on the disease has not seemed remarkable, although it does help to control secondary infection or pneumonitis *(15)*. Aureomycin has been tried with supposedly good results *(19)*.

Wammock et al. *(20)* used ACTH with excellent results. Agostas et al. *(21)* described the use of ACTH in a patient who was desperately ill and who responded to the drug within 48 hours. Another patient treated with cortisone by the same authors responded well but later had a recurrence. This patient was treated with ACTH without effect and when treated again with cortisone made a remarkable recovery. Fishman *(12)* reported a good response to the topical administration of cortisone in an 85-year-old woman with the Stevens-Johnson syndrome. Other drugs which have been used with varying results include the antihistaminics *(22,23)* and procaine given intravenously *(24)*.

The chief objectives of therapy in this condition should be to: (1) prevent secondary infection by the use of one of the antibiotics; (2) prevent ophthalmic complications by the use of continuous warm, moist compresses; and (3) maintain proper nutrition by the use of intravenous infusions of dextrose and by giving vitamin concentrates.

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(18) Bregman, A.: Treatment of erythema multiforme exudativum with sulfanilamide; report of case. Arch. Dermat. & Syph. 38: 623, Oct. 1938.

(19) Loewenthal, L. J. A.; Marais, J. L. B.; and Ruskin, H. D.: Stevens-Johnson syndrome; report of 2 cases treated with aureomycin. South African M. J. 24: 686-688, Aug. 19, 1950.

(20) Wammock, V. S.; Biederman, A. A.; and Jordan, R. S.: Erythema multiforme exudativum (Stevens-Johnson syndrome); report on patient treated with pituitary adrenocorticotropic hormone. J. A. M. A. 147: 637-639, Oct. 13, 1951.

(21) Agostas, W. M.; Reeves, N.; Shanks, E. D., Jr.; and Sydenstricker, V. P.: Erythema multiforme bullosum (Stevens-Johnson syndrome). New England J. Med. 246: 217-219, Feb. 7, 1952.

(22) Schoemperlen, C. B.: Benadryl in treatment of mucosal respiratory syndrome. Canad. M. A. J. 56: 73-74, Jan. 1947.

(23) Barba, W. P., II, and Tyson, A. M.: Stevens-Johnson disease; report of case. U. S. Armed Forces M. J. 1: 39-45, Jan. 1950.

(24) Appelbaum, E., and Aronson, S. M.: Erythema multiforme bullosum due to sulfadiazine sensitivity controlled with procaine intravenously. Ann. Int. Med. 31: 146-148, July 1949.

PROGNOSIS

The prognosis in this condition is good. Most patients recover without any residual complications, although there has been an occasional death (25). Recurrences occur frequently.

CASE REPORT

An 18-year-old Negro was admitted to this hospital on 1 January 1952 complaining of sore throat and difficulty in swallowing of 8 days' duration. He had been in good health until 24 December 1951 when he developed an upper respiratory infection with a persistent sore throat. On 28 December he sought medical aid and was given 300,000 units of penicillin by his family physician but continued to feel bad and remained moderately febrile. Because the patient was on leave, he was admitted to a civilian hospital on the following day. Here he was given penicillin and fluids with terramycin intravenously. On 30 December it was noted that his buccal mucosa was becoming ulcerated and a membrane appeared to be forming on his oropharynx. A throat smear showed diphtheroid organisms. In view of the patient's poor condition, the lack of response to therapy, and the results of the throat smear, the family physician believed that the patient might have diphtheria and promptly gave him 5,000 units of diphtheria antitoxin intravenously and 50,000 units intramuscularly. On the same day, the patient developed a purulent conjunctival discharge, an ulcer on the glans penis, and multiple bullous skin lesions on the arms, legs, chest, back, and abdomen.

On 1 January 1952 he was transferred to this hospital.

His temperature on admission was 102° F. There was a purulent discharge from both eyes. The buccal mucosa was red, ulcerated in spots, and covered with a white, friable pseudomembrane. No definite membrane was visible in the pharynx. There were many large bullas on his arms, legs, chest, abdomen, and back. There were also several erythematopapular lesions on the back of his hands and marked ulceration of the glans penis. His leukocyte count was 7,900 with 17 percent stab forms, 45 percent neutrophils, 21 percent lymphocytes, 3 percent monocytes, and 14 percent eosinophils. Urinalysis showed a trace of albumin and occasional red and white blood cells. The throat smear showed a few short gram-positive rods and gram-positive cocci. Nonhemolytic *Staphylococcus albus* was isolated from the throat culture.

The patient was isolated because of the possibility of diphtheria. Boric acid eyewashes and warm saline solution mouthwashes were given and he was injected with 300,000 units of procaine penicillin every 12 hours. On the second hospital day he was no better and had become lethargic. Many fresh ulcers had appeared on his buccal mucosa and lips. His entire body was covered with large bullas. There

(25) Johnstone, D. F.: Fatal case of Stevens-Johnson syndrome. Lancet 2: 276-277, Aug. 23, 1947.

was a purulent discharge around the urethral meatus and multiple ulcerations were noted on the glans penis. At this time, it was decided to change his therapy and all previous medications were discontinued. Treatment with 500 mg. of aureomycin every 6 hours was begun. Three percent aureomycin ointment was ordered for his lips and 3 percent aureomycin mouthwash was used 4 times a day. Continuous warm saline packs were applied to his eyes.

On the third hospital day his condition was unchanged. He was taking fluids well by mouth and 3 percent aureomycin ointment was applied to the cutaneous lesions. Since admission, his temperature had been fluctuating between 99° and 100° F. On the next day he was afebrile. His condition appeared somewhat improved and no new lesions were noted (figs. 1 and 2). He continued to eat poorly, but was taking fluids by mouth. On the fifth hospital day he was given feedings of protein hydrolysates between meals but he appeared listless. At this time he was taken off isolation. On the seventh hospital day, the bullas appeared to be drying up, but the glans penis showed extensive ulcerations with secondary infection. Continuous warm saline soaks were applied to his penis. He was given 1,000 cc. of 10 percent dextrose in saline solution intravenously and vitamin-B complex intramuscularly. His urine still showed many leukocytes, undoubtedly due to contamination from the balanitis. His leukocyte count was 9,700 with 20 percent stab forms, 38 percent neutrophils, 33 percent lymphocytes, 4 percent monocytes, and 5 percent eosinophils. His serum protein was 5.9 grams per 100 cc. (albumin 3.9 percent and globulin 2 percent) and his thymol turbidity was 7.5.

On the ninth hospital day he was much better. All of the bullas had dried up. He appeared alert, was cheerful, and was taking nourishment by mouth. His eyes appeared almost normal. From this day on, he improved steadily. On the fourteenth hospital day the dosage of aureomycin was reduced to 250 mg. every 6 hours. His leukocyte count was 6,000 with 4 percent stab forms, 62 percent neutrophils, 18 percent lymphocytes, 6 percent monocytes, and 10 percent eosinophils. His serum protein was 6.8 grams per 100 cc. Three more nose and throat cultures revealed only hemolytic *Staphylococcus aureus* and *Staph. albus.*

All medications were discontinued on 21 January. The ulcers on the lips and tongue were the last to heal but by 25 January all lesions had healed. On 6 February the patient went on a convalescent leave.

DISCUSSION

This patient presented the typical findings of the Stevens-Johnson syndrome. He had an ulcerative stomatitis, a purulent conjunctivitis, balanitis, and bullous skin lesions. In addition to the initial throat smear made prior to admission to this hospital (which showed gram-positive bacilli morphologically resembling *C. diphtheriae*), a throat

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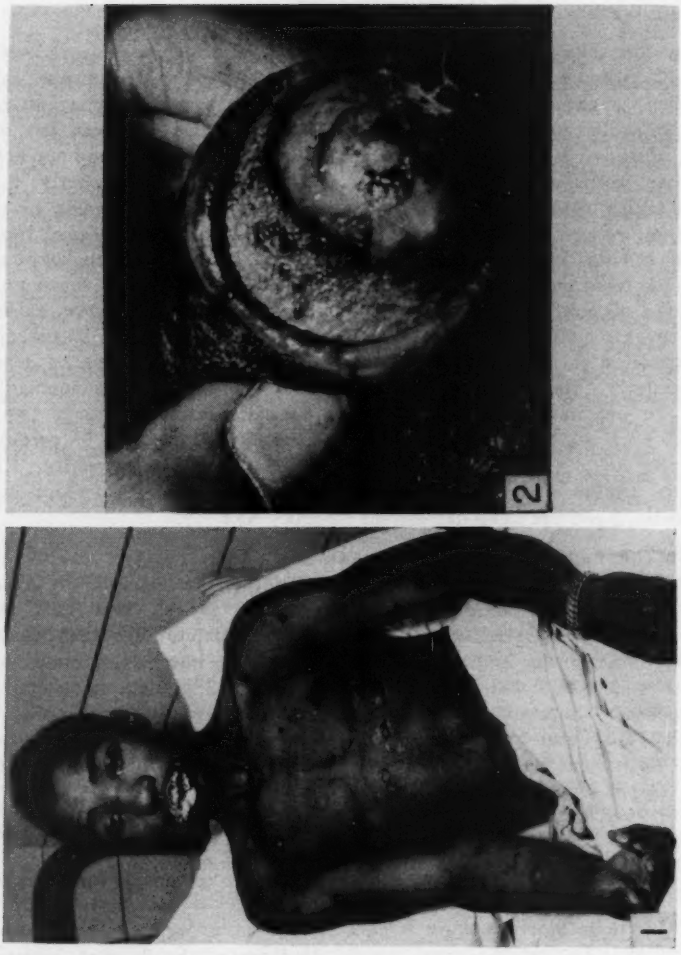

Figure 1. Appearance of the patient on the fourth hospital day showing multiple bullous lesions. Note aureomycin ointment on lips and purulent discharge from eyes. Figure 2. Penis showing marked balanitis.

culture with similar findings was also obtained. This brings up the possibility that the patient had cutaneous diphtheria. Reiss *(26)* reported 2 unusual cases of cutaneous diphtheria, one of which resembled the Stevens-Johnson syndrome. He suggested that this syndrome may represent a bacterial intoxication which, in rare instances, is caused by *C. diphtheriae.* He also stated that to confirm the diagnosis the organism must be cultured from the cutaneous lesions and that positive virulence studies must be obtained. In this patient, virulence studies of the throat culture and culture of the skin lesions were not done and, therefore, a definite diagnosis of cutaneous diphtheria could not be made. This patient was given aureomycin by mouth, aureomycin mouthwash, and aureomycin ointment. The total duration of his illness was 4 weeks. The therapy in this case was nonspecific but helped prevent secondary infection.

SUMMARY

A multiplicity of terms is used to describe a single clinical entity which, to avoid further confusion, and because the term is widely used, should be called the Stevens-Johnson syndrome. It is characterized by ulcerative stomatitis, purulent conjunctivitis, bullous and erythematopapular skin lesions, and balanitis, urethritis, or vaginitis. Because of the variability in its course and its self-limiting nature, it is difficult to evaluate any form of therapy. Treatment should be aimed at preventing secondary infection and ophthalmic complications and at maintaining nutrition.

(26) Reiss, F.: Cutaneous diphtheria; 2 unusual cases with eruptions resembling lymphogranuloma venereum and ectodermosis erosiva pluriorificialis. Arch. Dermat. & Syph. 56: 216-221, Aug. 1947.

ADDENDUM: Since submitting this article, we have treated another patient with Stevens-Johnson syndrome as outlined above, except that in addition to aureomycin, he was also given ACTH. Recovery appeared to be more rapid with the use of ACTH. It is suggested that the use of ACTH in conjunction with the antibiotics be given further clinical trial in treating this condition.

BOOK REVIEWS

Synopsis of Genitourinary Diseases, by *Austin I. Dodson,* M. D., F. A. C. S., Richmond, Va., Professor of Genitourinary Surgery, Medical College of Virginia; Genitourinary Surgeon to the Hospital Division, Medical College of Virginia; Genitourinary Surgeon to Crippled Children's Hospital; Urologist to St. Elizabeth's Hospital; Urologist to St. Luke's Hospital and McGuire Clinic, and *Donald L. Gilbert,* M. D., Instructor in Urology, Medical College of Virginia. 5th edition. 313 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., publisher, 1952.

This symposium of urologic diseases should be valuable to the medical student, the general practitioner, the general surgeon, the gynecologist, and the urologist. It is brief, concise, orderly, and clear. Perhaps because the authors were aiming at brevity, nothing has been included on the adrenal gland. The most far-reaching and important discoveries in urology in the last 5 years are those involving the physiology and surgery of the adrenal gland. The importance of the adrenal gland in fluid balance and pre- and post-operative states is monumental. A comparable review of adrenal surgery would add much to the value of this book.
—*Lt. Col. D. K. Worgan, MC, U. S. A.*

Pathology of the Cell, by *Gordon Roy Cameron,* M. B., D. Sc. (Melb.), F. R. C. P., F. R. S., Director of the Graham Research Laboratories and Professor of Morbid Anatomy at University College Hospital Medical School in the University of London. 840 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1952.

A review of the development of the cell theory and of the modifications of this theory introduces a detailed discussion of the cell, its parts, and its behavior as an isolated unit and as part of an organism. In the second part the author considers the abnormal cell. There is an exhaustive discussion of cellular responses to many types of injury and of the varied behavior of specialized cells. In part 3 Dr. Cameron views the dissatisfactions with the cellular theory and analyzes a variety of observations from embryologic, morphologic, functional, and pathologic studies which indicate that the cellular theory must be broadened. Part 4 is a brief review of the methods currently in use and in the process of development that show promise of broadening our information about cells, and especially the subcellular units. The bibliography is elaborate and is concentrated in the period 1920 to 1948, but there are numerous references to older literature. This is a valuable reference work and is excellent background for anyone seriously interested in the fundamentals of pathology and cell behavior.—*Lt. Col. J. P. Tollman, U. S. A. F. (MC)*

EN PASSANT INJURY OF THE SPINAL CORD

MALCOLM B. CARPENTER, *Lieutenant, MC, U. S. N. R. (1)*

REPORTS of "spinal cord concussion" among battle casualties are numerous in the literature *(2-9)* because indirect injury to the spinal cord by high velocity missiles, shell fragments, and blasts occur on a large scale in modern warfare. Review of such case reports indicated varying degrees of functional impairment of the neuraxis, wide differences in permanent neurologic sequelas, and pathologic findings lacking specific characteristics. That such a potpourri of derangements of function of the spinal cord should be considered an entity under the term spinal cord concussion (commotion de la moelle épinière; Rückenmarkserschutterung) seems unreasonable and has caused the term to become vague and devoid of exact connotation. (It is an interesting paradox that the term "cerebral concussion" is considered to have a more precise meaning and is accepted clinically although full agreement as to the exact nature of the pathologic changes has not been reached.)

The characteristic feature of these spinal cord injuries lies not in the clinical symptoms or the resulting pathologic alterations, but in the manner in which the injuries were sustained. It was frequently stated that the vertebral column was injured by a projectile although no direct injury to the spinal cord resulted. Holmes *(2)* stated, "Spinal concussion is most commonly seen

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(1) U. S. Naval Hospital, St. Albans, N. Y.

(2) Holmes, G.: Spinal injuries of warfare. (Goulstonian Lectures.) Brit. M. J. 2: 769-774, 815-821, 855-861, 1915.

(3) Claude, H., and Lhermitte, J.: Étude clinique et anatomo-pathologique de la commotion médullaire directe par projectiles de guerre. Ann. de méd. 2: 479-506, 1915.

(4) Claude, H., and Lhermitte, J.: Formes cliniques de la commotion de la moelle cervicale par projectiles de guerre. Rev. de méd. 35: 535-554, 1916.

(5) Ferraro, A.: Contributo alla conoscenza della anatomia pathologica della' distruzione primitiva del midollo spinale (cosi detta "necrosi traumatica"). Cervello 1: 361-445, Nov.-Dec. 1922.

(6) Lhermitte, J.: Étude de la commotion de la moelle. Rev. neurol. 1: 210-239, Feb. 1932.

(7) Baker, G. S., and Daniels, F., Jr.: Concussion of spinal cord in battle casualties. J. Neurosurg. 3: 206-211, May 1946.

(8) Livingston, W. K., and Newman, H. W.: Spinal cord "concussion" in war wounds. West. J. Surg. 54: 131-139, Apr. 1946.

(9) Lhermitte, J.: Étude sur la commotion de la moelle épinière. Folia Psychiat. Neurol. et Neurochir. Neerlandica 53: 293-305, Apr. 1950.

when the projectile has touched either a spinous or transverse process, which it may have fractured or not, but it may be also produced by a bullet which penetrates or perforates the body of a vertebra." Munro *(10)* went even further and concluded, "Concussion (of the spinal cord) is associated only with bullet wounds of the bony wall of the canal." Although it is conceivable that uncomplicated spinal cord concussion may result from such injuries, examination of the case reports indicate clinical symptoms and signs suggestive of and compatible with subtotal and total transverse cord lesions.

Examination of the spinal cords of patients dying of cord injuries revealed areas of focal necrosis, cavitation, large and small hemorrhages, glial proliferation and primary degeneration of nerve fibers. Spinal nerve root degeneration and alterations of the central canal were reported by Claude and Lhermitte *(3)* and Lhermitte *(11)*. Such findings were often observed over several segments. It would thus appear that although spinal cord concussion may have been present in these patients, it was frequently complicated by contusions, laceration, and acute vascular disturbances locally and in adjacent areas.

Studies of high velocity missile wounds conducted during World War II *(12)* demonstrated that extensive injury to a peripheral nerve might result from projectiles perforating tissue a considerable distance from the nerve trunk. The tremendous amounts of energy absorbed by the tissue seemed to produce the equivalent of an internal explosion. The amount of energy liberated and transmitted to the tissues has been estimated to be equal to the mass of the projectile times the cube of its velocity *(8)*. The application of this information to the problem of spinal cord injuries among battle casualties may help to explain those symptoms and signs referable to the spinal cord in patients with wounds not directly involving the neuraxis. Such injuries have been termed "en passant" injury of the spinal cord because impairment of neural function is believed to be a consequence of energy absorbed and transmitted from projectiles in their course through nonneural structures. In retrospect, it seems probable that many of the reported spinal cord "concussions" might be grouped within this classification.

MATERIAL

The patients forming the substance of this report were cas-

(10) Munro, D.: Cervical cord injuries; study of 101 cases. New England J. Med. 229: 919-933, Dec. 16, 1943.

(11) Lhermitte, J.: Étude des lesions histologiques fines de la commotion de la moelle épinière. Ann. de méd. 4: 295-307, 1917.

(12) Puckett, W. O.; Grundfest, H.; McElroy, W. D.; and McMillen, J. H.: Damage to peripheral nerves by high velocity missiles with direct hit. J. Neurosurg. 3: 294-305, July 1946.

ualties of the Korean conflict who sustained wounds not directly involving the neuraxis, but with symptoms and signs indicating impairment of spinal cord function. Material was drawn from routine admissions to the neurosurgical service of this hospital. The patients were all young men between 19 and 21 years of age. The levels of apparent spinal cord injury ranged from the fifth cervical to the tenth thoracic segments. Most of these patients were evacuated by air from Korea and arrived at fully equipped general hospitals in Japan within a few hours after being wounded. Unfortunately, complete case records covering the interval between the time the wounds were sustained and admission to this hospital were not available for all patients. Available data were supplemented by detailed histories taken from the patients on admission.

CASE REPORTS

Case 1. A 21-year-old man sustained multiple fragmentation wounds of the back on 2 September 1950 and fell to the ground. He was unable to move the lower limbs and all sensation was said to have been absent below the waist. He was evacuated by air to a hospital in Japan that day. On examination, complete flaccid paralysis and loss of all sensation below his tenth thoracic segment were found. Paralysis of his bowel and bladder function was complete. Priapism developed shortly after injury and was said to have persisted for about 24 hours. Roentgenograms of the chest and thoracic vertebras revealed multiple metallic foreign bodies in the region of the seventh and eighth thoracic vertebras and in the right upper abdominal cavity (thought to be embedded in the liver). A spinal tap disclosed a grossly bloody spinal fluid under normal pressure. The fluid dynamics were not impaired. Tidal drainage was instituted and the patient was sustained on parenteral fluids because all food and fluids taken orally were vomited. About 15 days after injury bilateral flexion and extension of his toes was noticed. A few days later spontaneous flexor spasms were observed in both his legs. Seventeen days after injury he had his first spontaneous bowel evacuation; 20 days after injury bladder sensation began to return and the patient regained control of the bladder sphincters. Measurements of residual urine were not made. The patient was evacuated to the United States by air, arriving at this hospital on 26 September.

On admission he appeared emaciated and chronically ill and complained of epigastric distress and inability to move the lower limbs. A granulating wound 3 by 4 cm. was present over the spinous process of his ninth thoracic vertebra. His right upper extremity appeared somewhat less developed than the left and interrogation revealed a history of poliomyelitis at age 3. Both of his lower limbs could be weakly flexed at the

hip, knee, and ankle, though movement was limited. Painless muscle spasms were present in both lower extremities in flexor and extensor muscle groups. The deep tendon reflexes in his lower limbs were brisk, about equal with wide reflexogenic zones, exaggerated amplitudes, and lowered thresholds. Plantar responses were bilaterally extensor and no abdominal or cremasteric reflexes could be elicited. Spontaneous ankle clonus was frequently observed. Pinprick was appreciated as "dull pressure" below his tenth thoracic segment and all other sensations were absent below this level. He could void spontaneously, but fecal incontinence persisted.

One month after injury he was able to sit up in bed and could stand unaided for a few moments. Within another week he was using the paraplegic walker. On 14 October he could walk the length of the ward with the aid of 2 canes. Spinal fluid examination at this time was within normal limits. On 24 January 1951 he was fully ambulatory. His gait was unequivocally spastic —his thighs were adducted and his knees close together. Increased resistance to passive movement was marked in his lower limbs. No change in the superficial or myotatic reflexes was evident and spontaneous ankle clonus persisted. Moderate weakness was found in all muscle groups of his lower extremities. Sensory examination indicated that vibratory sense was present above both his patellas. Thermal sense was absent below his ninth and hypesthesia and hypalgesia were found below his tenth thoracic segment.

On 8 February the neurologic status was found unchanged except for increased spasticity in the antigravity muscle groups of his lower limbs. The initial resistance to passive flexion of his leg at the knee was great but was mitigated as the range of movement increased. By 27 May the spasticity in his legs was still marked. His gait was insecure, jerky, and ataxic and his thighs were adducted, though he was able to run short distances in an awkward manner. The weakness in his lower extremities seemed most pronounced in the proximal muscle groups. His upper abdominal reflexes were sluggish. His lower abdominal and cremasteric reflexes could not be elicited. Plantar responses were still extensor and spontaneous ankle clonus persisted, although it was not as frequent as before. Reflex spinal sweating could be provoked by nociceptive stimuli or pressure over the bladder.

Case 2. A 19-year-old man sustained multiple fragmentation wounds of the neck on 24 September 1950 following which he was unconscious for a period of time estimated to be about 30 minutes. On regaining consciousness he was unable to move any part of his body except the head and neck. All sensation

was reported to have been absent below the cervical region, although he described a tingling sensation throughout his body. He was evacuated by air to a hospital in Japan on the following day. Examination disclosed a quadriplegic man with complete anesthesia below the lower margin of his mandible. His bowel and bladder were completely paralyzed. Roentgenograms of the cervical region revealed several irregular metallic foreign bodies in the soft tissues of his neck on the right and a comminuted fracture of the spinous process of his third cervical vertebra. The tingling sensation initially complained of disappeared on the eighth day, at which time bladder sensation and control returned. About 12 days after injury, flexion and extension of his toes were noted and 2 days later his lower extremities could be weakly flexed at the hip, knee, and ankle. Pain, tactile, and thermal sense apparently returned about this time and were noted first in his lower limbs. Twenty days after injury he was able to sit up; 30 days after injury he could stand unaided and walk with assistance. Fecal incontinence disappeared about this time.

On 16 November he arrived at this hospital fully ambulatory and complaining of loss of sensation in his hands and feet and weakness in his right leg. Examination revealed hypesthesia and hypalgesia to cotton wool and pinprick in the second and third divisions of his trigeminal nerve on the right. No impairment of thermal sense was noted in this region. Hypesthesia and hypalgesia were reported over the occipital portion of his scalp and in the area below his right mandible (cutaneous distribution of fibers from the second cervical root). In spite of the apparent diminution of pain and tactile sense over his scalp, gentle upward brushing of the hair provoked an unpleasant sensation causing him to withdraw. A vibrating tuning fork applied to this region likewise prompted withdrawal. Tests of co-ordination disclosed (1) impairment of rapid successive movements, (2) slight dysmetria, and (3) epipraxic tremor in both of his upper extremities. (Editor's note: An epipraxic tremor occurs at the end of movement or during relaxation. Carrea, R. M. E., and Mettler, F. A.: Physiologic consequences following extensive removals of cerebellar cortex and deep cerebellar nuclei and effect of secondary cerebral ablations in the primate. J. Comp. Neurol. 87: 169-288, Dec. 1947.) His gait was broad-based and ataxic in character. In the Romberg position he tended to fall to the right and backward. Weakness was noted in all muscle groups of both his upper extremities, being most pronounced in the proximal groups. In his lower extremities weakness was likewise greater in the proximal muscles, particularly on the right. No alteration of muscle tone was evident. Atrophy of the intrinsic muscles of both his hands was detectable but not

localized to specific peripheral nerve distributions and not severe. Skilled movements were impaired in both his hands to such an extent that he required assistance to dress and feed himself. No abdominal or cremasteric reflexes could be elicited. His deep tendon reflexes were brisk, equal, and increased in amplitude. Plantar stimulation provoked unequivocal extension of his hallux bilaterally. Sensory examination revealed anesthesia and analgesia over the volar surface of the tip of his left thumb and index finger. Hypesthesia and hypalgesia were found over the lateral aspect of the palm and the thenar eminence of his left hand. In his right hand the distal portions of the thumb, index, and middle fingers were anesthetic and analgesic but his palm was hypesthetic and hypalgesic. Vibratory and position sense were diminished in all digits of both his hands. Thermal sense was impaired in both hands, but anhidrosis was not found. Stereognosis was greatly impaired.

By 2 December his cremasteric reflexes were found to be brisk and equal, although no abdominal reflexes could be obtained. His deep tendon reflexes were unchanged, but the left plantar response had become intermittently flexor and extensor. On 10 January 1951 his plantar responses were found to be bilaterally flexor and thereafter remained flexor. On 31 May the entire neurologic examination was within normal limits except for slight weakness of the grasp in his right hand, bilateral impairment of skilled movements in the hands, and the sensory disturbances previously noted in his face and hands. On 10 December slight hypesthesia and hypalgesia in his thumb and index finger bilaterally were the only residual neurologic deficits.

Case 3. A 19-year-old man sustained multiple fragmentation wounds of the back and chest on 14 August 1950 following which he was either unconscious or amnesic or both intermittently for 7 days. At the termination of this period he complained of lumbosacral pain and was unable to move his left lower extremity. He stated that sensation was absent below the umbilicus on the left side. No priapism or impairment of bowel or bladder function was present. During the first week of September, flexion and extension of the toes of his left foot were noticed. Roentgenograms of the chest disclosed numerous metallic foreign bodies located (1) deep within the posterior mediastinum at the level of his fourth thoracic segment, (2) overlying his right scapula, (3) in the second intercostal space on the left, and (4) in the left paravertebral area near his tenth rib. None of the foreign bodies appeared to have penetrated his thoracic or abdominal cavities. Roentgenograms of the skull revealed several superficial irregular metallic foreign bodies in his left temporal

region. No adequate neurologic examination was made until January 1951 when he was admitted to this hospital, but the record did indicate that he became ambulatory during the third week of September 1950.

On admission he complained of (1) radicular pain in the dermatomic distribution of the eighth thoracic segment on his left side, (2) weakness of his left leg, and (3) impaired sensation in both his lower limbs. Neurologic examination revealed an ambulatory patient whose gait demonstrated hyperextension of his left leg at the knee with minimal circumduction of the entire limb. In the Romberg position he tended to fall backward and to the left. The weakness in his left leg was most pronounced in the proximal muscle groups (i. e., quadriceps, hamstrings, and adductors). The muscular tone was diminished in this extremity in all groups and measurement of his left lower extremity at various points with reference to bony prominences disclosed moderate atrophy of his thigh and leg.

The deep tendon reflexes were exaggerated in both his lower limbs but to a greater extent on the left. Sustained patellar and ankle clonus were elicited on the left. His abdominal and cremasteric reflexes were bilaterally present but sluggish on the left. Unequivocal extension of his hallux was obtained by plantar stimulation on the left but extension was only occasionally elicited on the right. Sensory examination disclosed hypesthesia and hypalgesia in his eighth and ninth thoracic dermatomes on the right and anesthesia and analgesia below that level on the right. Thermal sense was absent below his eighth thoracic segment on the right. Pain and tactile sense were preserved on the left except for a small zone over his eighth thoracic dermatome. Proprioceptive and vibratory sense were diminished but not absent below his iliac crests. Tests of co-ordination were poorly performed with his lower extremities but no disturbance of co-ordination was present in his upper extremities. A spinal tap revealed a crystal-clear spinal fluid under normal pressure. No impairment of spinal fluid dynamics was present. Laboratory examination of the spinal fluid was normal except for a protein of 60 mg. per 100 cc.

During 8 months of hospitalization repeated neurologic examinations disclosed few changes. The muscular weakness in the patient's left lower limb improved greatly, but was always detectable, particularly in the proximal muscular groups. His gait became practically normal and he was able to walk well on his heels and toes. He was also able to run. The sensory deficits described remained, except for improvement of the position and vibratory sense, particularly in his right leg. No alteration of his superficial or deep tendon reflexes occurred

and extension was consistently elicited by plantar stimulation on the left. Patellar and ankle clonus on his left were always elicited with ease. His only complaint was occasional radicular pain on the left at the apparent site of the lesion.

Case 4. A man sustained a perforating wound of the neck on 29 November 1950. The missile entered near the anterior border of his right sternocleidomastoid muscle and emerged caudal to his seventh cervical vertebra. After an unconscious interval of about 30 minutes, he noted that he was unable to move his right extremities and all sensation was said to have been absent in the affected limbs. He complained only of dull pain in his right shoulder and neck. Paresthesias were experienced in his right foot. No impairment of speech, deglutition, or respiration was apparent and bowel and bladder function were normal. Six days after injury he could weakly flex and extend his right toes and sensation was commencing to return in his right lower extremity. Roentgenograms of the cervical regions revealed a fracture of the spinous process of his seventh cervical vertebra. Fourteen days after injury sufficient strength had returned to his right leg to enable him to walk with assistance. Numbness and paresthesias appeared in his right upper extremity and were soon followed by evidence of returning pain and tactile sense. He was evacuated through successive commands and arrived fully ambulatory at this hospital on 25 January 1951.

On admission he complained of numbness and tingling in his right upper extremity, a sensation of swelling in his right hand, and weakness in both right extremities. Examination revealed functionally intact cranial nerves except for slight weakness of his right sternocleidomastoid muscle and the upper portion of his trapezius muscle. He was unsteady in the Romberg position and tended to fall backward and to the left. The weakness in his right upper extremity was greater than that in his lower extremity and was particularly marked in the supraspinatus, infraspinatus, deltoid, and biceps muscles. The weakness in his lower extremity was most noticeable in the proximal groups. His supraspinatus, infraspinatus, deltoid, and trapezius muscles were atrophic on the right. Abduction and forward flexion of his right arm were limited to less than 90 degrees. The myotatic reflexes were brisk, equal, and active except in his right upper extremity where no reflexes could be elicited. His abdominal and cremasteric reflexes were sluggish bilaterally. His right plantar response was extensor. Sensory examination revealed hypesthesia and hypalgesia over his right occipital region and over the distribution of his ulnar and medial antebrachial cutaneous nerves. Inconstant patchy hypesthesia and hypalgesia were noted in the cutaneous areas overlying his deltoid and triceps muscles. Slight diminution of proprioceptive sense was

apparent in the toes of his right foot, but vibratory sense was everywhere intact. A lumbar tap revealed clear spinal fluid under normal tension. No impairment of fluid dynamics was found. Chronaxy of the nerves of his right upper extremity was normal.

On 19 February he complained of an electric shocklike sensation that shot down his back into his left arm and both legs and which was provoked by forward flexion of his neck. The force of this shocklike sensation was sufficient on at least 2 occasions to cause him to fall to his knees. This sensation seemed to originate in the lower cervical region and descended rapidly down the back into the posterior aspects of his thighs, legs, and feet. It caused momentary weakness in his legs and was succeeded by stiffness and a tingling sensation which lasted a few seconds. Occasionally this sensation radiated down the medial aspect of his left arm, but it was never as violent in his upper as in his lower limbs. This phenomenon occurred whether he was lying down, sitting, or standing, but was most marked when he was standing. It was most severe if his neck was fully extended and then quickly flexed. Repeated neurologic examinations indicated gradual and progressive return of strength in the muscles of his right extremities and return of sensation in his right upper extremity. Roentgenograms of his lumbar vertebras disclosed a spina bifida occulta.

By 19 April the muscular weakness in his right extremities was barely detectable and the range of motion was normal. The deep tendon reflexes remained sluggish in his right arm. Some diminution in the severity of his "electric shocks" occurred with time, but it was May before it ceased to be bothersome. At that time the patient was returned to duty.

Case 5. A 21-year-old man sustained a perforating missile wound of the neck on 28 November 1950. The missile entered on the left side about 5 cm. below the mastoid process and emerged from the posterolateral surface of the neck on the right about 2 cm. from the ligamentum nuchae. After being hit, the patient was not unconscious and experienced only a burning sensation over the back of the neck. His entire body below the neck was devoid of feeling and no voluntary movement was possible. Within a few minutes he was evacuated by stretcher to a rear area and after about 45 minutes he was able to sit up and stand unaided. On the following day he was fully ambulatory and without complaint. His wound healed following debridement without complication. During the following 2 weeks he noted weakness in turning his head from side to side and weakness in the muscles of both arms. About 10 days after injury he experienced an electric shocklike sensation which

radiated down his back and into both arms and legs on flexing and extending his head. Two months later this sensation became worse and radiated into his fingers and toes. He noted that this sensation (also described as a buzzing) could be provoked by flexing his trunk. Thereafter this disagreeable sensation constituted his sole complaint.

On 22 May 1951 he was admitted to this hospital where a neurologic examination revealed that his left pupil was slightly smaller than his right and reacted sluggishly to light. No evidence of a Horner's syndrome was present. Slight bilateral weakness of his biceps and triceps muscles was present, but no evidence of atrophy was found. His deep tendon reflexes were active, brisk, and equal and his plantar responses were bilaterally flexor. His abdominal and cremasteric reflexes were within normal limits. A lumbar puncture revealed a clear spinal fluid under normal tension with a protein content of 54 mg. per 100 cc. Because of the paucity of positive neurologic findings, the patient was discharged to duty 5 days after admission.

Two weeks later he was readmitted still complaining of "electric shocks" down his back on flexion and extension of his neck and flexion of his trunk. A neurologic examination revealed that his pupils were round, regular, and equal and reacted promptly to light. Hypesthesia and hypalgesia were noted over the distribution of the second and third divisions of his left trigeminal nerve. Bilateral weakness of his sternocleidomastoid muscles was still present and slight weakness was noted in the grasp and the extensor muscles of his left hand. He was unsteady in the Romberg position and tended to fall backward. Proprioceptive sense was diminished in his toes bilaterally. His left abdominal and cremasteric reflexes were absent and his left plantar response was occasionally extensor. Hyperhidrosis was noted over his palms and soles bilaterally. A lumbar puncture revealed a clear spinal fluid and an initial pressure of 150 mm. Manometrics performed with a sphygmomanometer, with the patient's head first in flexion and then in extension, revealed values consistent with a partial subarachnoid block. Operation was advised by the neurosurgical staff, but was refused by the patient.

DISCUSSION

Spinal shock. Total abolition of all tendon reflexes and profound depression of all other reflex activity below the level of the spinal lesion (i. e., spinal shock) was definitely present in 3 of these patients. The duration of this state was 15 days in one, 8 days in another, and only 45 minutes in the third. In the patient in whom spinal shock persisted for 15 days, grossly bloody spinal fluid was found after injury, indicating

damage to the vessels of the cord and possibly a secondary hematomyelia. This complication may, in part, explain the duration of spinal shock. In patients 3 and 4 it was impossible to determine the duration of spinal shock because a period of unconsciousness followed injury. Associated head injury occurred in patient 3, but no detectable neurologic deficit above level of the spinal injury was evident on admission to this hospital. On regaining consciousness reflex activity was present below the level of the apparent lesion and neurologic symptoms and signs indicated predominately unilateral involvement of the spinal cord. Although under experimental conditions animals usually do not develop spinal shock as a consequence of unilateral section of the spinal cord, it is well to remember that the traumatizing forces producing en passant injury are not localized. Priapism was said to have been present in 1 patient for about 24 hours after injury. Kocher *(13)* reported this phenomenon as a frequent occurrence immediately after complete severance of the spinal cord. This was cited by him as one of the genital reflexes that may persist or even become exaggerated following division of the spinal cord.

Reflex activity. Usually the appearance of toe movements (flexion) is arbitrarily taken as the first indication of the termination of spinal shock. This was the case in 3 of these patients and was succeeded by the progressive return of reflex activity in more proximal muscle groups. Triple flexion responses were provoked in the first 3 patients by cutaneous plantar stimulation and nociceptive stimulation within the genital zone and occasionally over the medial aspects of the thighs. The return of flexor activity was observed to occur in a distal-to-proximal sequence.

Although records were not sufficiently complete to indicate the precise time after injury when deep tendon and cutaneous reflexes were first elicited, at least 3 patients exhibited tendon reflexes with low thresholds, wide reflexogenic zones, rapid maturation, spread to adjacent muscle groups, large amplitudes, and a brisk quality below the level of the cord injury on admission to this hospital. Bilaterally sustained ankle clonus was noted in patient 1 and unilateral ankle clonus was found in patient 3. One patient with a unilateral cervical cord injury exhibited exaggerated myotatic reflexes in the lower extremity and areflexia in the affected upper limb. No significant alterations of the tendon reflexes were found in 1 patient. In time, the tendon reflexes returned to the normal range, except in the first and third patients who evidenced severe spinal cord damage. Ankle clonus of a sustained type persisted in these patients.

(13) Kocher, T. L.: Die Verletzungen der Wirbelsäule zugleich als Beitrag zur Physiologie des menschlichen Rückenmarks; II. Die Lasionen des Rückenmarks bei Verletzungen der Virbelsäule. Mitt. a. d. Grenzgeb. d. Med. u. Chir. 1: 415-661, 1896.

Initial examination revealed absent abdominal and cremasteric reflexes in 4 patients. In all but the first patient these cutaneous reflexes ultimately returned to normal. Usually the cremasteric reflexes could be elicited before the abdominal reflexes. Unequivocal extensor toe responses were provoked bilaterally in patients 1 and 2 and unilaterally in patients 3 and 4. In patient 5 an occasional unilateral Babinski sign was observed. Plantar responses became flexor in time in all except in patients 1 and 3. About 107 days after injury the plantar responses became flexor in patient 2. The same change was noted in patient 4 after 60 days.

Motor recovery. Subsiding paresis was usually noted first in the peripheral portions of the lower extremities and was observed to progress to more proximal muscle groups. In the patients with cervical cord injury, return of motor function was always noted first in the lower extremities and was followed by subsidence of paresis in the muscles of the forearm, arm, and shoulder girdle. This manner of recovery is probably a consequence of local vascular trauma, irreversible cell changes (primarily anterior horn cells), and, in some patients, degeneration of peripheral nerve fibers as a result of radicular involvement. The residual motor deficit in the patient with an atypical Brown-Séquard syndrome (patient 3) was minimal after 8 months although practically no improvement of the concomitant sensory disturbances occurred. All of the signs which clinically are accepted as indicating a lesion of the pyramidal tract (Babinski sign, hyperactive deep tendon reflexes, and easily elicited and sustained ankle clonus) persisted, but the patient's activities and general motor performance were nearly normal. The findings in this patient, although lacking anatomic confirmation, would seem to support similar results obtained in monkeys following verified hemisection of the spinal cord *(14)*. Hypotonia was found in the affected musculature of 4 patients and in the other spasticity developed early and remained practically unchanged. Unilateral hypotonia in the lower extremity as indicated by reduced resistance to passive movement was marked in patient 3, but was associated with greatly exaggerated tendon reflexes and sustained ankle clonus.

Sensory changes. Immediately after injury most patients stated that "numbness" was present below the level of the spinal cord injury, but 1 patient described a tingling or vibrating sensation in his foot on the affected side soon after injury. Definite sensory levels were found in only 2 patients on admission to this hospital. In 1 patient all sensations except pain were absent below the tenth thoracic segment and a pinprick was reported as a

(14) Mettler, F. A.: Observations on consequences of large subtotal lesions of the simian spinal cord. J. Comp. Neurol. 81: 339-360, Dec. 1944.

dull pressure. In the other (patient 3), anesthesia, analgesia, and thermanesthesia were present on the right side below the eighth thoracic segment and proprioceptive and vibratory sense were impaired below the iliac crests bilaterally. Reduction in the impairment of position and vibratory sense in these patients occurred in time, but no appreciable change was noted in the other sensations.

Sensory deficits in the remaining patients varied. Proprioceptive sense was impaired in the peripheral portions of the lower extremities in 2 patients and in the fingers and toes of a third. Patchy hypesthesia and hypalgesia were found in the distribution of certain cervical roots both above and below the estimated level of maximal spinal cord trauma in 3 patients. The tips of the thumb and index finger remained anesthetic and analgesic for almost a year after injury in patient 2. The impairment of sensation in these patients gradually diminished in time and completely disappeared in 2 of them.

Two patients with estimated maximal injury of the fifth and sixth cervical segments, respectively, reported that a pinprick and touching with cotton wool were not felt over the lower part of the face (second and third divisions of the trigeminal nerve distribution). No impairment of thermal sense in this region could be demonstrated. Explanation of such sensory changes is difficult because, (1) the descending root of the trigeminal nerve is believed to extend caudally only as far as the first cervical segment *(15, 16)* or at most to the level of the second cervical segment *(17, 18)*; (2) the most caudal fibers of the descending root are believed to mediate sensation arising from the first division of the trigeminal distribution, but the most rostral fibers are associated with the third division and the fibers between, with the second division *(17)*; and (3) the descending root of the trigeminal nerve is believed to mediate only pain and thermal sense. In spite of this anatomic evidence, varying degrees of hypesthesia have been reported associated with absent or reduced pain and thermal sense in appropriate portions of the face following trigeminal tractotomy *(15, 16,*

(15) Sjöqvist, O.: Studies of pain conduction in trigeminal nerve; contribution to surgical treatment of facial pain. Acta psychiat. et neurol., supp. 17, pp. 1-139, 1938.

(16) Walker, A. E.: Origin, course and terminations of secondary pathways of trigeminal nerve in Primates. J. Comp. Neurol. 71: 59-89, Aug. 1939.

(17) Smyth, G. E.: Systemization and central connections of spinal tract and nucleus of trigeminal nerve; clinical and pathologic study. Brain 62: 41-87, Mar. 1939.

(18) Elvidge, A. R., and Li, C. L.: Central protrusion of cervical intervertebral disk involving descending trigeminal tract; report of case. Arch. Neurol. & Psychiat. 63: 455-466, Mar. 1950.

19-22). The diminished tactile sense described in these reports was for the most part minimal and could be detected only with Frey's hairs, except in a few patients. Elvidge and Li *(18)* reported a patient with central protrusion of the intervertebral disk between the fourth and fifth cervical vertebras and in whom absent corneal sensation and reflexes and circular areas of anesthesia, analgesia, and thermanesthesia were found bilaterally over each cheek. Tactile sense in this patient was absent to light touching with cotton wool. The findings in the patients reported here cannot be correlated with accepted anatomic data and may represent a functional condition.

Two patients manifested the sign of Lhermitte (an electric shocklike or vibratory sensation radiating down the back, frequently from the cervical region, into the extremities). This disturbing phenomenon became fully developed after about 8 weeks in 1 patient and appeared suddenly after 11 weeks in another. When this sensory disturbance was fully developed it constituted the principal complaint. The sensations were so severe in 1 patient that he fell to his knees. This phenomenon is not always precipitated by flexion of the neck; sometimes extension of the neck or flexion of the trunk serves as the exciting maneuver *(23).* Although Lhermitte et al. *(24)* described this symptom as a specific sign of early multiple sclerosis, it is frequently found in other conditions (spinal cord tumors, Pott's disease, subacute combined sclerosis, spinal cord trauma, and head injuries). Bender and Furlow *(25)* reported the occurrence of this sign in 17 battle casualties sustaining head injuries and considered its cause to be simultaneous contrecoup injury of the spinal cord. The precise mechanism of this sensory disturbance remains to be elucidated, but available evidence seems to implicate the posterior columns as the system mediating the phenomenon because most of the patients exhibited proprioceptive deficits and the sensation experienced is described as being similar to that perceived from a vibrating

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(19) Grant, F. C.; Groff, R. A.; and Lewy, F. H.: Section of descending spinal root of fifth cranial nerve. Arch. Neurol. & Psychiat. 43: 498-509, Mar. 1940.

(20) Weinberger, L. M., and Grant, F. C.: Experiences with intramedullary tractotomy; studies in sensation. Arch. Neurol. & Psychiat. 48: 355-381, Sept. 1942.

(21) Hamby, W. B.; Shinners, B. M.; and Marsh, I. A.: Trigeminal tractotomy; observations on 48 cases. Arch. Surg. 57: 171-177, July 1948.

(22) Guidetti, B.: Tractotomy for relief of trigeminal neuralgia; observations in 124 cases. J. Neurosurg. 7: 499-508, Nov. 1950.

(23) Salmon, L. A.: Sensation of electric shock in multiple sclerosis. Bull. Neurol. Inst. New York 6: 378-384, Aug. 1937.

(24) Lhermitte, J.; Lévy, G.; and Nicolas, M.: Les sensations de décharge électrique; symptôme précoce de la sclérose en plaques, clinique et pathogénie. Presse méd. 35: 610-613, May 14, 1927.

(25) Bender, M. B., and Furlow, L. T.: Sensations of electric shock on flexion of neck as sign of head injury. J. Neurosurg. 3: 212-218, May 1946.

tuning fork applied to a bony prominence. Whatever the mechanism may be, it would seem that this symptom indicates an intrinsic lesion of the spinal cord.

Autonomic function. Transient impairment of bowel and bladder function occurred in patients 1 and 2. Bladder control was regained after 20 days by patient 1 and after 8 days by patient 2. Residual urine undoubtedly was present, but no measurements of it were made. The return of bladder sensation occurred simultaneously with return of voluntary control of micturition, as would be expected because the stimulus for micturition is derived from pressure distending the bladder. Fecal incontinence persisted for about 30 days in both of these patients. It is of interest that the return of bladder function preceded the return of bowel control. Reflex spinal sweating was observed in patient 1. Somatic and visceral nociceptive stimuli produced profuse sweating below the level of the lesion (tenth thoracic segment) but the cutaneous areas above that level remained dry. List and Pimenta *(26)* have described this autonomic response in patients with complete severance of the spinal cord and have attributed it to isolation of the spinal cord from the hypothalamic thermoregulatory centers. Penile erection was possible in all patients and ejaculation was normal in all but one.

Spinal cord concussion. Probably the most illuminating and conclusive study of spinal cord concussion has come from the laboratory. Groat et al. *(27)* studied spinal cord concussion in the cat and defined the condition as "a complete functional block of the spinal cord at the level of application of an adequate force to the nervous parenchymal." The period of concussion was brief, lasting a matter of minutes, and was characterized by spinal shock and paralysis. This was succeeded by a postconcussion period during which the paralysis disappeared and reflex activity was resumed. Neurons, principally internuncial, and long ascending and descending tracts were the structures bearing the brunt of the insult. Histologic cell alterations, including frank chromatolysis, were demonstrable, but no gross functional disturbances referable to the spinal cord were discernible in the postconcussion period. The force necessary to produce spinal cord concussion in man is unknown, but it is likely that more severe physiologic changes would occur in man because primates are subject to more profound and lasting spinal shock than carnivores.

None of the patients here presented represented uncomplicated

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(26) List, C. F., and Pimenta, A. deM.: Sweat secretion in man; spinal reflex sweating. Arch. Neurol. & Psychiat. 51: 501-507, June 1944.

(27) Groat, R. A.; Rambach, W. A., Jr.; and Windle, W. F.: Concussion of spinal cord; experimental study and critique of use of term. Surg., Gynec. & Obst. 81: 63-74. July 1945.

spinal cord concussion. Objective motor and sensory disturbances outlasting spinal shock, indicates that physiologic dysfunction of the spinal cord was not limited to internuncial neurons and long ascending and descending fasciculi. The pathologic process probably affected all structures within the spinal cord over a great distance, but not to the same degree. The posterior columns, spinothalamic tracts, and nerve roots seemed particularly vulnerable.

SUMMARY

The 5 cases of spinal cord damage resulting from missile and shell fragment not directly involving the neuraxis, but with varying degrees of transient and permanent neurologic deficits described here have been classified as en passant injury of the spinal cord. These myelopathies are believed to be the result of tremendous amounts of energy absorbed and transmitted to the spinal cord from projectiles in their course through nonneural structures.

Correction

The author of the article titled "Evaluation of the Rapid Heterophile Antibody Slide Test" which appeared on pp. 947-952 of the June 1952 issue of the Journal has requested that the following change be made in his manuscript as submitted. Lines 15 and 16, p. 951, reading, "and the presence of heterophile agglutinins absorbed on guinea pig kidney and not on ox cells," should be corrected to read as follows: "and the presence of heterophile agglutinins absorbed on ox cells and not on guinea pig kidney."

VIRAL HEPATITIS IN U. S. TROOPS IN GERMANY[1-3]

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DOROTHY M. HORSTMANN, *M. D.*

IN view of the fact that hepatitis rates have continued to be high among troops in the Army of Occupation in Germany (EUCOM), various possible methods of the control of this disease continue to deserve review. Among methods proposed to reduce the high rate (which has ranged from 6 to 18 per 1,000 per annum) the administration of gamma globulin to individual soldiers in that area as a prophylactic measure [4-6] has been repeatedly discussed. Before arriving at decisions on this point, it is important to estimate whether or not an optimum time or times exist at which one or more doses of gamma globulin might be administered to troops in this area. For this reason, we have collected information over the 52-month period, 1 March 1947 to 1 July 1951, as to the usual time spent in Germany by United States soldiers, before they contracted hepatitis.

If the degree of exposure to hepatitis were the same for each month during the first 24 or 48 months of service in Germany, soldiers should theoretically be *more* susceptible during their first few months as unseasoned newcomers to the endemic area than would be the case later. The duration of the "seasoning process" for hepatitis in this situation has not yet been determined. Previous estimates, compiled from data available in 1949 [7], indicated that although relatively few of the United States soldiers in Germany acquired hepatitis during the first

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(1) Representing work of the Virus and Rickettsial Disease Commission, Armed Forces Epidemiological Board.

(2) From the Section of Preventive Medicine, Yale University School of Medicine.

(3) Also from the 98th General Hospital, European Command, U. S. Army.

(4) Stokes, J., Jr., and Neefe, J. R.: Prevention and attenuation of infectious hepatitis by gamma globulin. J. A. M. A. 127: 144-145, Jan. 20, 1945.

(5) Gellis, S. S.; Stokes, J., Jr.; Brother, G. M.; Hall, W. M.; Gilmore, H. R.; Beyer, E.; and Morrissey, R. A.: Use of human immune serum globulin (gamma globulin) in infectious (epidemic) hepatitis in the Mediterranean Theater of Operations; studies on prophylaxis in 2 epidemics of infectious hepatitis. J. A. M. A. 128: 1062-1063, Aug. 11, 1945.

(6) Havens, W. P., Jr., and Paul, J. R.: Prevention of infectious hepatitis with gamma globulin. J. A. M. A. 129: 270-272, Sept. 22, 1945.

(7) Paul, J. R., and Gardner, H. T.: Symposium on viral hepatitis; endemiologic aspects of hepatitis in U. S. troops in Germany, 1946-1950. Am. J. Med. 8: 565-580, May 1950.

5 months of service in the occupation zone, most of the cases were acquired in the soldier's sixth to thirteenth month. *Month specific rates* were not, however, calculated in 1949 and, furthermore, since that year many United States soldiers have served for longer periods of time in Germany than was the case earlier, the previous estimate on the duration of this "seasoning period" in EUCOM requires revision.

METHODS

Case data. Since 1947, the Medical Department of EUCOM has maintained a Hepatitis Center to which most, but not all, patients with hepatitis acquired in Germany were admitted. Questionnaires with inquiries relative to the date of onset of the illness and the number of months which each soldier had spent in Germany prior to his illness were prepared and completed on the patients admitted to this center over this 52-month period *(8)*. The number of patients with hepatitis on whom such data was available is shown in table 1.

TABLE 1. *Number of patients admitted to the Hepatitis Center on whom questionnaires were completed.*

Year	Patients
1947	709
1948	1165
1949	768
1950	618
1951	153*
Grand total	3413

*First half of year only.

Military population data. Ideal military population data of the type desired for the estimation of rates is difficult to secure, particularly in a situation of this type where men were moving in and out of the military area at variable intervals and staying for variable periods of time. Throughout the 5-year period (1947-1951) most of the men stayed in Germany for only 2 years and in 1949 there were relatively few soldiers who had served

(8) In the completion of these questionnaires, we have been assisted in 1947-1949 at the 120th Station Hospital; and in 1949-1951 at the 98th General Hospital, by the following representatives of the Virus and Rickettsial Disease Commission: Dr. H. T. Gardner, Dr. W. E. Swift, and Dr. J. W. Colbert; and in 1950-1951 by others including: Dr. L. Bungards and Capt. A. S. Evans, MC, U. S. A. The assistance of Lt. Col. H. Sprinz, MC, U. S. A., Director of Laboratories at the 98th General Hospital, is also gratefully acknowledged.

there longer than 3 years, whereas by 1951 an appreciable percent of the total military population had served there for from 3 to 5 years. Population data dealing with the duration of overseas service were obtained from sample surveys, representing from 4 to 5 percent of the total military population, usually made 4 times a year, during the period 1947-1951*. No such data, however, were available for 1948. In some of the most recent surveys (1950-1951) the data were complete and indicated the percent of soldiers who had served in Germany for each of the 75 preceding months; whereas in others, the periods of overseas service was expressed in much broader terms, i. e., as less than 3 months, from 4 to 6 months, from 7 to 12 months, from 13 to 24 months, et cetera.

Prevalence of hepatitis. A number of methods have been used for estimating the prevalence of hepatitis in men who served in Germany for various periods of time. Two will be reported here, namely (i) that of estimating month-of-service** specific rates and (ii) the mere listing of the numbers of patients with hepatitis per month of service in EUCOM.

i. If adequate population data had been available for an estimate of this kind it would have been desirable to have completed, 2,600 times, the following equation:

$$\frac{h\,(n)}{p\,(n)} \times 12 \times 1{,}000 = R$$

in which h equals the number of cases of hepatitis per month occurring in United States soldiers at a given time, such as March 1947, April 1947, et cetera, repeating the months 52 times, if proper coverage of the period March 1947 to July 1951 were to be made. In *each* of these "given times" the cases were also broken down into duration of service, arbitrarily assuming that the maximum service was 50 months. Therefore n equals the duration of service expressed by a number, ranging from 1 to 50 (months); p equals the corresponding number of United States soldiers in EUCOM in each of the 52 months (for each of the 50 months of service). R (the quotient) therefore equals the *month-of-service specific hepatitis rate* (MSSHR) per 1,000 men, for each of the above situations. It has been expressed in terms of an annual rate by multiplying it by 12.

Theoretically then the quotient should be obtained 50 times for each of the 52 months in the period between March 1947 and July 1951. Actually the population data were so limited that the

*We are indebted to Maj. Gen. Guy B. Denit, Chief Surgeon, European Command; to Col. R. L. Callison, MC, Preventive Medicine Branch; and to Lt. Col. M. G. Morrison, MSC, of the Medical Statistics Section, Medical Division, EUCOM, for the data on the various lengths of stay in Germany by the military population in different years.

**The term *month of service* implies month of service in Germany.

equation could be completed for about 550 situations only, and in almost half of these, only approximate values for h were available. Nevertheless the results when compiled are probably significant and compare favorably with estimates made by other methods. Our estimated rates (MSSHR) have a relative value only and indicate a series of *comparisons* only of what happened from month to month over the years. These are not the official rates because our hepatitis case data dealt only with patients hospitalized at the Center whose questionnaires were completed, and these represented a decreasing fraction of the total number of patients with hepatitis in EUCOM during the 52-month period of the study.

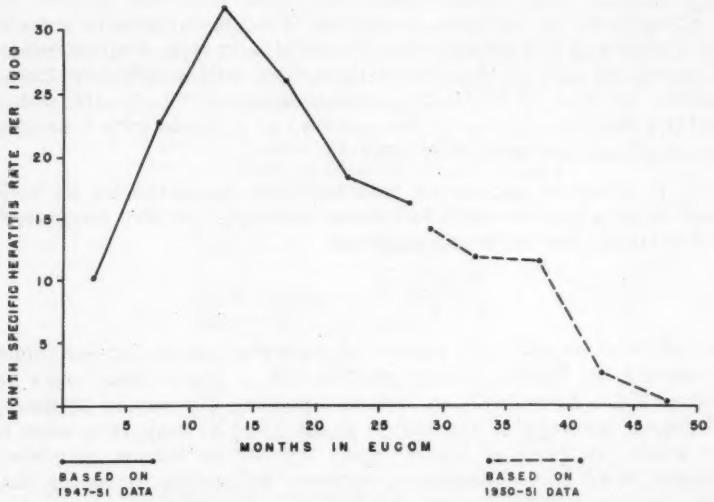

Figure 1. Graph showing rates at which United States soldiers have contracted hepatitis in relation to their months of service in EUCOM. (This only includes patients admitted to the Hepatitis Center.)

In figure 1 we have charted these *month of service specific rates*. The graph has been constructed from two sources of military population data: the first 27 months being based on 5-year data, and the last 23 months from data representing the 18-month period, 1 January 1950 to 1 July 1951. The trend indicates low susceptibility or exposure to hepatitis in the first 5 months of service in EUCOM, rising to a peak of 12.5 months and falling off to low levels at about the thirtieth month.

ii. As another type of analysis, we have simply charted the number of patients with hepatitis from the entire series of about 2,400 cases which occurred during the first 25 months of service

in EUCOM and have divided them into those who had served there for from 1 to 25 months, respectively (fig. 2). The number of cases is based on a fluctuating population and its significance cannot be appreciated without a comparison with corresponding population data. Because such population data are not available for the 25- to 50-month period of service, figure 2 is limited to 25 months service only. The curve representing the military population trend has been expressed in terms of arbitrary units, derived from the percent of men who have been in EUCOM for from 1 to 25 months during the period 1947-1951.

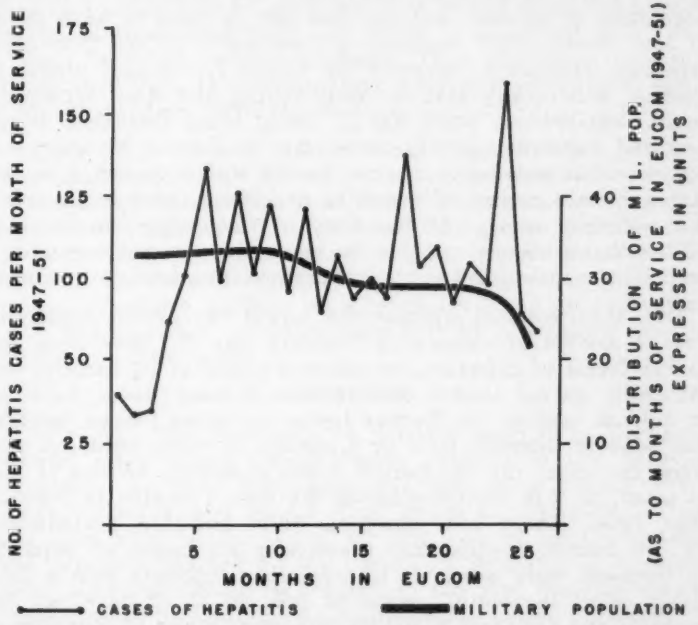

Figure 2. The number of hepatitis patients admitted to the Hepatitis Center during 1947-1951, with onset, charted according to months of service in EUCOM. The case data can be compared with the graph expressing in arbitrary units the relative distribution of the military population during that same period.

The curve indicating the number of cases has prominent peaks at 18 and 24 months of service, which we believe almost certainly is due to the average soldier's tendency to speak in "round numbers" about his months of overseas service. When he cannot recall exactly the date of his arrival in EUCOM, he is apt to say that he has been there "a year and a half," "two years," et cetera. Figure 2 indicates that the cases (and by

inference, the rates) began to rise sharply during the fourth, fifth, and sixth months of service in EUCOM and were maintained at high levels during the entire subsequent 20 months.

COMMENT

In spite of the inadequacy of the data at our disposal, we believe they are sufficient to establish the fact that acquisition of hepatitis occurs at a relatively low level during the United States soldier's first 4 months in Germany. The rate then rises, reaches a peak at about 12 months, and declines slowly, but it is not until the soldier has been in Germany for more than 30 months that the rate can be said to have fallen to low levels. This endemiologic situation differs from other hepatitis situations recorded by Gauld *(9)* among troops in combat, particularly that in North Africa and Italy during the years 1943-1945 in World War II. Gauld found that fresh troops acquired hepatitis quickly under the conditions of heavy exposure sustained during combat in the Mediterranean area and that a certain degree of immunity developed rather soon among the seasoned troops. In the Army of Occupation in Germany, United States troops seem to be gradually exposed over longer periods. Seasoning and accompanying immunity occur very slowly.

One also wonders whether the initial lag period during the first 4 months of service in Germany may not have been due to the factor of exposure, or rather the lack of it, namely, that the newly arrived soldier did not have as many "local contacts" or did not venture into German homes or eating places until he had been in Germany for 4 or 5 months. In other words, if such were the case, the lag period would obviously be due in part at least, to less exposure during the first 4 months in Germany than later. There are, however, other possible explanations for we cannot assume that practically all cases of hepatitis in Germany were examples of *infectious hepatitis* with a relatively short incubation period of from 20 to 30 days, as was probably the case with hepatitis in combat troops. A fair percent of hepatitis cases in occupation troops may be *serum hepatitis* with the longer incubation period of from 60 to 120 days. This in itself might account in part for the lag by setting the time of onset back from 2 to 4 months.

In any event, if protection of military personnel is to be sought through *passive* immunization it does not appear theoretically that there is any optimum time for the administration of gamma globulin for this purpose to individual soldiers of the Army of

(9) Gauld, R. L.: Epidemiological field studies of infectious hepatitis in Mediterranean Theater of Operations; selection among American troops. Am. J. Hyg. 43: 299-309, May 1946.

Occupation during their third to thirtieth month of service in Germany. Unless gamma globulin were administered by repeated injections, let us say 3 months apart, to United States troops in Germany, theoretically there would be scant hope of effectively reducing the hepatitis rate by inducing *passive immunity*. This would hardly seem to be a practical procedure. We do not mean to imply, however, that it should *not* be done.

It is possible that single or multiple doses of gamma globulin administered during the third to the thirtieth month of service might be effective in inducing a *passive-active* type of immunity *(10)*. This could only be expected to be effective in that a small percent of inoculated men who within a relatively short time of their injection became exposed. This chance of exposure (or exposure rate), if estimated from the recent case rates, would be less than 10 per 1,000 per month.

On the other hand, it is also conceivable that the effect of gamma globulin in this disease is of a third and different type and, as suggested by Stokes et al. *(10)*, immunization is really *active* and brought about by the fact that gamma globulin contains a mixture of antigen and antibody, i. e., epidemic hepatitis virus and its neutralizing antibody. Thus the degree of effectiveness of gamma globulin as a prophylactic agent, regardless of the way it works, could perhaps only be determined through experimental field trials.

SUMMARY

During the first 4 months of military service in Germany, hepatitis rates among United States soldiers in the Army of Occupation are low. Following this lag period, these rates increase sharply and remain high for about 2½ years. Peak rates come at about the end of the first year of service in Germany. Methods devised for the control of hepatitis in this particular situation should be related to the fact that the period of seasoning of local troops against hepatitis seems to be long indeed. Many men are still susceptible to hepatitis 18 to 24 months after their arrival in the endemic area. On the basis of existing data, which point to a low but prolonged index of exposure, gamma globulin administration does not appear at present to be a practical prophylactic measure to be recommended as a routine procedure for the prevention of hepatitis. This conclusion does not imply that it should not be tried if suitable field experiments can be devised.

(10) Stokes, J., Jr.; Farquhar, J. A.; Drake, M. E.; Capps, R. B.; Ward, C. S., Jr.; and Kitts, A. W.: Infectious hepatitis; length of protection by immune serum globulin (gamma globulin) during epidemics. J. A. M. A. 147: 714-719, Oct. 20, 1951.

Visit to the Alameda Medical Supply Depot

Dr. Melvin A. Casberg, Chairman of the Armed Forces Medical Policy Council; Major General S. B. Hays, Deputy Surgeon General of the Army; Brigadier General H. H. Twitchell, Chief of the Planning Coordination Division of the Armed Forces Medical Policy Council; and Mr. James Jenkins, representative of the Office of the Comptroller in the Office of the Secretary of Defense, visited the Alameda Medical Supply Depot, Alameda, Calif., on 6 and 7 August 1952 to obtain background information concerning the Medical Supply Test and to study the physical facilities and methods of warehousing at that depot.

Colonel S. G. Asbill, VC, U. S. A., the commanding officer, gave the group an excellent orientation covering the functioning of the Alameda Medical Supply Test which was conducted between 1 March and 31 August 1952. The Test was instituted by direction of the Secretary of Defense under the supervision of the Munitions Board in order to evaluate the feasibility of consolidating the responsibility for distribution, depot storage, and issue and maintenance of medical supply items in the Armed Services.

This group believed that the Test was experimentally well designed. In their analyses of the various components, it appeared to be a feasible operation. A distribution system of this nature for medical supplies must demonstrate a thorough capability of medical response to command requirements.

In 1949 the Medical Departments of the Army, Navy, and Air Force established one of the original joint supply procurement agencies in the Department of Defense. It is possible that as a result of this Medical Supply Test the Medical Departments of the Army, Navy, and Air Force will again be the forerunners in another area of tri-service supply procedures.

INTRAVENOUS USE OF PROCAINE TO RELIEVE POSTOPERATIVE PAIN

JACK B. JAY, *Captain, U. S. A. F. (MC) (1)*

SAM F. SEELEY, *Brigadier General, MC, U. S. A. (1)*

MUCH has been written about the intravenous use of procaine for a multitude of conditions, but few controlled studies have been made. A test of its efficiency when used immediately after operation on a controlled group of patients is reported. About 44 years ago, Bier *(2)* first injected procaine intravenously distal to a tourniquet placed on a patient's leg. Excellent anesthesia for from 3 to 4 hours in other patients was noted, but on release of the tourniquet, convulsions frequently and death occasionally followed. For this reason the injection of procaine into the vascular system, as advocated by Bier, soon fell in disrepute. Only recently has the widespread intravenous use of this drug for the relief of pain become apparent, and it is now being used for everything from anesthesia in obstetrics and orthopedics to relieving intractable pruritus.

Little has been written about its use to relieve postoperative pain. Winter *(3)* reported a series of 80 patients in whom 95 percent experienced satisfactory analgesia, lasting from 10 to 14 hours. In all but 4, no other sedation was necessary and no severe reactions resulted. Respiratory difficulties, marked apathy, drowsiness, and vomiting, as is frequently experienced with the use of morphine, were absent. McLachlin *(4)* reported its use, with encouraging results, in 10 patients following major operations and Gordon *(5)* reported excellent relief from pain in burned patients during the first dressing period. Mushin and Rendell-Baker *(6)* found that a high degree of relief, with absence of respiratory depression, was obtained after abdominal operations, but that the method required constant and skilled medical

(1) Surgical Service, Walter Reed Army Hospital, Washington, D. C.

(2) Bier, A.: Ueber einem neuen Weg Lokalanasthesia, in den Gliedmassen zu erzeugen. Verhandl. d. deutsch. Gesellsch. f. Chir. 37: 204, 1908.

(3) Winter, L.: Intravenous procaine infusions in postoperative period. Ann. Surg. 132: 143-146, July 1950.

(4) McLachlin, J. A.: Intravenous use of novocaine as substitute for morphine in postoperative care. Canad. M. A. J. 52: 383-386, Apr. 1945.

(5) Gordon, R. A.: Intravenous novocaine for analgesia in burns (preliminary report). Canad. M. A. J. 49: 478-481, Dec. 1943.

(6) Mushin, W. W., and Rendell-Baker, L.: Intravenous procaine; a review. Lancet 1: 619, Apr. 9, 1949.

attention. Rovenstine (7), in a series of over 500 patients, stated that the severe postoperative pain of upper abdominal and thoracic operations responded poorly to procaine, but that about 66 percent of other surgical patients were relieved. One-third of this latter group responded to placebos.

Recently Keats et al. (8) reported a controlled and unselected series of 53 surgical patients, only 40 percent of whom obtained relief from postoperative pain with procaine, as contrasted with 20 percent who obtained relief with saline solution, and 70 percent who obtained relief with morphine given intravenously. He found that the analgesia was often accompanied by unpleasant and, at times, serious side effects. Because of the rapid fluid administration and the variability of toxic side effects, physician attendance was mandatory. Kibler and Schnaper (9), using the Wolff-Hardy and Goodell technic, discovered that procaine given intravenously elevated the pain threshold only slightly during the infusion period. They further emphasized that the answer awaits a controlled clinical test because the elevation of the pain threshold is only one of the possible modes of action of an analgesic.

Method. In a series of 50 patients, 5 percent dextrose in distilled water with 2 cc. of vitamin B complex for coloring was given intravenously immediately after operation when the patient first began complaining of pain. The patient was informed that the infusion was for the relief of pain. If pain persisted, procaine in the amount necessary to make a 0.2 percent solution, was added to the infusion. In the event the procaine failed, it was in turn replaced after from 30 to 60 minutes by a narcotic which was then evaluated for pain relief and comfort after another 30 to 60 minutes. Most of the procaine was administered by a trained nursing staff on the recovery ward. The 1 liter procaine infusion was administered over a period of 2 or 3 hours. One physician was on emergency call at all times. There were 23 orthopedic, 11 neurosurgical (excluding cranial), 10 urologic, and 6 major abdominal operations. Patients with thoracic operations were excluded on the basis of the poor results reported by Rovenstine (7).

The *results* are shown in table 1. Half of the patients experienced some relief from pain. Most of those who obtained only partial relief stated that they were fairly comfortable. Two patients experienced complete relief from the dextrose in distilled water. Not more than 2 grams of procaine were administered in a 12-hour period, and those patients who experienced relief did not require analgesics until the following day. The narcotics ordered, usually demerol or morphine, gave relief in all but 1 patient.

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(7) Rovenstine, E. A.: Personal communication.

(8) Keats, A. S.; D'Alessandro, G. L.; and Beecher, H. K.: Controlled study of pain relief by intravenous procaine. Council on Pharmacy and Chemistry Sec. J. A. M. A. 147: 1761-1763, Dec. 29, 1951.

(9) Kibler, R. F., and Schnaper, H. W.: Effect of procaine administered intravenously on cutaneous pain threshold. Am. J. M. Sc. 220: 199-202, Aug. 1950.

TABLE 1. *Results obtained from postoperative administration of procaine intravenously*

Operation	Relief			Placebo given	Number	Percent obtaining relief*
	Complete	Partial	None			
Orthopedic	7	6	8	2	23	62
Neurosurgical	4	1	6		11	45
Urologic	1	2	7		10	30
Abdominal	1	3	2		6	66
Total	13	12	23	2	50	52

*Patients getting placebo did *not* get the procaine and therefore were not included in this figure.

Reactions were few and these were not serious. One patient developed a moderate hypotension; 1 experienced nausea, vomiting, and slow, thick speech; and 1 had marked dyspnea and was very apprehensive. Observers thought the dyspnea was due more to anxiety than to the procaine. It was rapidly relieved with an injection of phenobarbital.

Comment. The effect of drugs on pain is difficult to evaluate. Only a rough clinical evaluation, based on relief of pain in a controlled series of 50 patients has been made. Procaine, given in the manner described, is impractical for alleviating postoperative pain because it often conflicts with the patient's fluid requirements and adds another uncomfortable needle. As an example, consider the patient whose intravenous infusion of 5 percent dextrose was begun in the operating room. Frequently, before the patient reacts from the anesthesia and begins to complain of pain, his fluid requirement has been absorbed. Cardiac patients necessarily present a formidable problem. The method also necessitates additional care, thus placing another load on overworked nursing staffs. Reactions have been few, and despite earlier reports the method does not seem to require the continuous presence of a physician, but because only one-half of the patients respond, this procedure has no real advantage over the present method of treating postoperative pain.

CONCLUSIONS

Using a controlled series of 50 postoperative patients, an attempt was made to evaluate pain relief with the use of 0.2 percent procaine given intravenously. These patients underwent a cross section of major surgical (excluding thoracic) operations. Complete and partial relief was obtained in 50 percent of the patients and there were no serious reactions. The use of procaine for the control of postoperative pain is considered impractical because (1) it fails to give adequate pain relief in a high percent of patients, (2) it often interferes with the patient's fluid requirements, (3) it places an additional burden on the nursing staff, and (4) it means one more needle for the patient.

PERSONALITY CHANGES FOLLOWING CARDIAC ARREST(1)

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IRWIN R. STERNLICHT, *First Lieutenant, MSC, A. U. S.*
OSWALD M. WEAVER, *Lieutenant Colonel, MC, U. S. A.*

PERSONALITY changes may occur as a result of cerebral anoxia, particularly when the anoxia is of sufficient duration to cause irreversible brain damage. Personality is considered to mean, "All a person has been, is now, and is trying to become. It is the entire individual including mind, intelligence, emotions and bodily organs. It embraces all of a person's attributes, his physical structure, his lives and his habits, his play and his work and his reaction to his environment and to everyone in it" *(2)*. Personality changes resulting from cardiac arrest may range from mild, transient disturbances to total cessation of cerebral functioning and death. The personality changes from cardiac arrest are the result of anoxia and are, as a consequence, identical or similar to those caused by anoxia from any other cause.

The true significance of oxygen lack and the resultant histopathologic changes were summarized by Haldane *(3)* in 1912 when he said, "Anoxia not only stops the machine but wrecks the machinery." Courville *(4)* stated that anesthetic asphyxia may result in many personality changes and he listed 9 types of pathologic finding: (1) acute psychosis, (2) hyperkinesis, (3) decerebrate states, (4) residual psychoneurotic traits, often chronic, (5) certain chronic psychotic states, (6) parkinsonism, (7) lenticular syndrome, (8) blindness, and (9) rare and atypical mainfestations. He also regarded asphyxia neonatorum as being the probable cause of many cases of spasticity, athetosis, and mental deficiency in children—conditions the cause of which had previously been obscure.

Cerebral anoxia from any cause, whether of the anoxic, anemic, stagnant, or histotoxic type, is an extremely serious disease. It has been estimated that cerebral anoxia for over 3½ minutes may result in

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(1) Department of Neuropsychiatry, Fitzsimons Army Hospital, Denver, Colo.

(2) Menninger, W. C.: Psychiatry: Its Evolution and Present Status. Cornell University Press, Ithaca, N. Y. 1948. p. 4.

(3) Haldane: Quoted by Burdick, D. L.; Lisa, J. R.; and Elias, M. G.: Anoxia and central nervous system; review and case report. Anesthesiology 10: 369-373, July 1949; correction 10: 756, Nov. 1949.

(4) Courville, C. B.: Cerebral anoxia and its residuals; asphyxial syndromes, acute, subacute, and chronic. M. Arts & Sc. 2: 67-79, Apr. 1948.

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permanent injury or even death to its victims. It is universally agreed that the duration of the anoxia and not the cause is of paramount importance in determining the prognosis. Clinical manifestations, according to Courville (5), do not necessarily parallel evidence of physical damage to the brain. He was of the opinion that profound mainfestations may be present in the early period when there is little to be seen and, at the same time, extensive recovery may occur even in the presence of grossly evident lesions.

The cerebral cortex has a high rate of oxygen consumption and a high metabolic rate. This area of the brain has, perhaps, a greater number of cells per unit volume than any other region in the body. Douglas (6) offers the hypothesis that the regions of the brain with the highest metabolic rate suffer most from oxygen lack. The layers of the cerebral cortex which appear to suffer most are laminas 3 and 4, particularly in the precentral and calcarine areas. Some authors believe that the Purkinje cells of the cerebellum suffer greatly. Chornyak (7) said, "Stimulation of nerve cells by oxygen deprivation produces the most severe cell changes in those nerve cells having the highest metabolic rate. They are affected earliest by the slightest decrease in oxygen and are most rapidly exhausted from this increased functional activity and are destroyed."

Reporting a patient who died about 1 month after cardiac arrest, Löken et al. (8) stated that the pathologic changes were particularly conspicuous in the calcarine and adjacent cortical areas, namely, 17, 18, and part of 19, of Brodmann. They noted that as a rule lamina 3 suffered the greatest damage. Knowing in general the areas most severely damaged by anoxia, we can predict with some accuracy the resulting personality changes and, in the case report which follows, these predictions seem to be borne out.

CASE REPORT

A 21-year-old soldier underwent a tonsillectomy on 22 August 1951 in an overseas hospital. His throat was sprayed with 10 percent cocaine and local procaine infiltration anesthesia was used. He was given 100 mg. of pentobarbital preoperatively. Shortly after the operation he complained of a severe headache, went into a convulsive state, and breathed deeply at the rate of 4 or 5 times a minute, becoming at the same time cyanotic. He was immediately given oxygen by inhalation and a surgeon was summoned. The patient was intubated without dif-

(5) Courville, C. B.: Cerebral anoxia and its residuals; structural changes. M. Arts & Sc. 1: 68-78, Oct. 1947.

(6) Douglas, A. S. (Toronto): Cerebral changes related to anoxia, with report of case. Canad. M. A. J. 61: 123-129, Aug. 1949.

(7) Chornyak, J.: Pathogenesis of structural changes in central nervous system produced by anoxemia. Bull. U. S. Army M. Dept. 8: 695-702, Sept. 1948.

(8) Löken, A. C.; Haymaker, W.; and Paulson, D. L.: Stab wound of heart followed by temporary cessation of heartbeat with resuscitation by cardiac massage; clinicopathologic study of 1 case of 30 days' survival. Surgery 26: 745-755, Nov. 1949.

ficulty and, without sterile preparation, a thoracotomy between the third and fourth ribs was performed about 5 minutes after the episode started. Later the costal cartilage in the medial angle of the incisional wound was incised to allow more room.

The heart was found to be in complete standstill and massage was started. Massage was at about 80 beats a minute and a blood pressure of 90/50 was obtained. One cubic centimeter of 1:1000 epinephrine was injected into the heart muscle and, after about 10 minutes of massage, fibrillary vermicular movements were noted. Five cubic centimeters of 2 percent procaine were injected intracardially and massage was continued. Ten minutes later, irregular ventricular contractions were noted and 10 cc. of 2 percent procaine were injected while massage was continued. In about 5 more minutes a regular beat was maintained and the chest was closed. Five hundred cubic centimeters of blood were given during the procedure. An ECG made in the operating room revealed a left bundle branch block. Later the same day, the rate occasionally increased from 136 to 176 beats a minute. The patient left the operating room in an unconscious condition with a blood pressure of 88/72 and a temperature of 101° F. His respiratory rate was 30. By 2045 hours there appeared to be some lessening of his deep coma, and a slight lid reflex was present. An endotracheal tube was used to give oxygen at the rate of 9 liters a minute. A water-sealed chest drainage which had been installed at the time of the operation was functioning satisfactorily and the patient had shown no increase in the subcutaneous emphysema noted roentgenographically after the operation.

On 23 August there was little change in his condition. His lungs were expanded and there was some congestion. His hematocrit was 54 and his hemoglobin was 18.2 grams per 100 cc. Later that night, the endotracheal tube was removed and cough, swallowing, and lid reflexes were found to be present. He also showed evidence of pain when pressure was made on the ulnar styloid process.

On 24 August he appeared to be stuporous but somewhat improved. On 25 August he reacted to sensory stimuli. His trachea was kept clear of mucus by suction. Vital signs were said to be stable. On 27 August he was still unconscious. Reflexes were present but he would not swallow fluids. Instead, he spit them out immediately. He did not react to verbal stimuli. His temperature was 100.6° F. and his blood pressure was normal. On 28 August a gastrostomy of the Witzel type and a tracheotomy were performed. On 29 August he voided spontaneously, but still offered no response to questioning. On 30 August oxygen inhalation was discontinued. On 4 September the tracheotomy tube was removed. On 5 September he was able to drink a cup of milk and his temperature was normal. On 7 September the tracheotomy wound was closed and the gastrostomy tube was removed. An ECG suggested epicardial damage. On that day he began talking but was disoriented. On 8 September he answered simple questions and took food by mouth. On 10 September he was transferred to the closed neuropsychiatric ward where

he showed general mental retardation and disability but was compliant to repeated urgings and directions. He responded appropriately and relevantly at a moronic level. He was thin and weak but ate well when spoon fed. Unsupervised, he would urinate and defecate anywhere, but would take care not to soil himself. Although by 18 September he was improving, his vision was poor in both eyes and he could not count fingers. All operative wounds were healed.

He was transferred to this hospital, arriving on 22 October. He made a poor adjustment on the open ward and it became necessary to transfer him to the closed ward about 5 days after his admission because he would not bathe, had to be fed, and on one occasion put a cigarette out on a napkin, starting a small fire. He appeared pleasant but unkempt. His vision on 4 December was 20/400 bilaterally. This improved to 20/20 bilaterally by 21 December. Neurologic and mental status examinations included Rorschach, level aspiration, Wechsler-Bellevue, color form sorting, and Bender-Gestalt tests, Wechsler-Bellevue memory scale, and the Medical Field Service School test for aphasia *(9, 10)*. The patient was unable to distinguish blue and green, and red and orange.

On the basic aphasia status examination *(9)* he revealed a number of signs indicating visual and partial tactile agnosia, graphomotor aphasia, and motor ataxia. The visual agnosia became evident on his not being able to recognize several common objects such as a key or a penny. The key was finally recognized when he grasped it, but he was unable to tell what the penny was, even when feeling it, other than it was possibly a coin. The graphomotor-visual aphasia was manifested in inability to write or even trace his name. His visual-motor ataxia was apparent in the manner in which he overcompensated for fluctuating depth perception. He lifted his legs quite high when walking and brought them uncertainly down to the floor, or else didn't lift them at all. He gave objects such as chairs and tables an unnecessarily wide berth.

Initially, on 25 October he could not function at all on the Wechsler-Bellevue performance subtests. On the verbal part, he scored zero on arithmetic but 10 on comprehension. His judgment was good but he concentrated poorly. His digit span score was 7, indicating an adequate recent memory function. His memory for past events was poor; for recent events, good *(11, 12)*. He could not remember in what year he was born,

(9) TM 8-242-AFM 160-45. Military Clinical Psychology. Departments of the Army and the Air Force, July 1951.

(10) Abt, L. E., and Bellak, L. (editors): Projective Psychology. Alfred A. Knopf, Inc., New York, N. Y. 1950.

(11) Rapaport, D.; Gill, M.; and Schafer, R.: Diagnostic Psychological Testing: The Theory, Statistical Evaluation, and Diagnostic Application of Battery of Tests. Vol. 1. Menninger Clinic Monograph Series No. 3. Year Book Publishers, Inc., Chicago, Ill., 1945.

(12) Rapaport, D.; Gill, M.; and Schafer, R.: Diagnostic Psychological Testing: The Theory, Statistical Evaluation, and Diagnostic Application of Battery of Tests. Vol. 2. Menninger Clinic Monograph Series No. 4. Year Book Publishers, Inc., Chicago, Ill., 1946.

but he could recall what he had had for breakfast. His general information was meager but suggested a premorbid level of average or better than average intelligence. He produced no scorable responses on the Rorschach test, but merely described the cards in terms of lines and curves in what was an attempt to impress the examiner with his precision, but succeeded only in being concrete *(13)*. He was disoriented to time, missing the date by about a month. Motor signs included a cautious gait with heavy, high steps. On many occasions he stubbed his toe, but he overcame this handicap by watching his feet. He had a definite, mild dysdiadochokinesia which gradually improved. He was co-operative on the ward, but had to be carefully supervised at first. He showed interest in other patients and in the student nurses, saying in December about one of them, "I want to buy her for Christmas."

By 8 January 1952 minimal improvement could be noted in specific areas, such as abstract capacity as scored by the Wechsler-Bellevue test and in his aphasia and agnosia. No measurable improvement could be found in the area of long-term memory function or in his performance on other tests, although clinically the impression was one of improvement.

His mother thought he was functioning at about 40 percent of his normal level, but that most of his difficulty was in visual and memory areas. She, too, noticed much improvement as at first he did not recognize either her or his sister.

Because of his good judgment and immediate memory function and because he is treatable and shows a rather high level of frustration tolerance, the prognosis for further improvement under a concentrated retraining program appears to be good.

(13) Goldstein, K., and Scheerer, M.: Abstract and Concrete Behavior. (Psychological Monographs, Vol. 53, No. 2.) American Psychological Association, Inc., Northwestern University, Evanston, Ill., 1941.

BOOK REVIEWS

A Textbook of Pathology, by *E. T. Bell,* M. D., Emeritus Professor of Pathology in the University of Minnesota, Minneapolis, Minn. Contributors: *B. J. Clawson,* M. D., Emeritus Professor of Pathology in the University of Minnesota, and *J. S. McCartney,* M. D., Professor of Pathology in the University of Minnesota. 7th edition. 1,008 pages; illustrated. Lea & Febiger, Philadelphia, Pa., publisher, 1952. Price $12.

This book presents concisely the fundamental aspects of pathology in a well-organized and integrated fashion. It should be of especial value to medical students and beginners in path-

ology as well as to experienced pathologists who desire to review the entire field of pathology. This text is unusually complete and gives an excellent coverage of the subjects usually included in such a book.

Pathology, like other branches in medicine, has become increasingly complex and this book succeeds in clarifying some of its confusing aspects. It takes up the basic fundamentals but they have been greatly enlarged on since the publication of the first edition. The diseases of the blood, a subject which is becoming more and more complicated, are especially well-discussed. The chapter on tumors is also especially good. It includes a general discussion and a section on the causes of tumors which is up to date, including experimental production of cancer, and then finally the classification of tumors and the discussion of each group. Students would save themselves a great deal of misdirected effort by applying themselves to this section and making it a part of their basic knowledge.

—*Col. D. M. Kuhns, MC, U. S. A.*

Text-Book of Ophthalmology. Volume V, The Ocular Adnexa, by Sir *Stewart Duke-Elder,* K. C. V. O., M. A., LL. D., D. Sc. (St. And.), Ph. D. (London.), M. D., F. R. C. S., Hon. D. Sc. (Northwestern), D. M. (Utrecht), F. R. C. S. (Edin.), F. A. C. S., Surgeon Oculist to H. M. The King; Knight of Grace, Order of St. John; Consulting Ophthalmic Surgeon to the British Army and the Royal Air Force; Fellow, University College, London; Director of Research, Institute of Ophthalmology, University of London; Honorary Consulting Surgeon, Moorfields Westminster and Central Eye Hospital; Ophthalmic Surgeon, St. George's Hospital, London. 1082 pages; 1181 illustrations; 32 in color. The C. V. Mosby Co., St. Louis, Mo., publisher, 1952.

The first 4 volumes of this textbook were enthusiastically accepted as most outstanding contributions to modern ophthalmic literature. Volume 5 adds another superior book to this series. It covers in great detail developmental anomalies and diseases of the lids, the lacrimal apparatus, the orbit, and of the paraorbital regions. The volume is written in the inimitable Duke-Elder style, superbly illustrated, and well printed. This book belongs, with the preceding volumes by the same author, in the library of every ophthalmologist and as a reference in every library available to the physician. It is not intended for the medical student but is indispensable to the resident in ophthalmology. The appearance of a volume in this series in past years has been hailed as a major event in the advance of ophthalmology. This year is no exception and we eagerly look forward to the next volume.—*Col. J. H. King, Jr., MC, U. S. A.*

THE URINOIL[1]

INGALLS H. SIMMONS, *Lieutenant Colonel, MC, U. S. A.*
VERNON H. NEUBERT, *First Lieutenant, MSC, A. U. S.*
ARTHUR L. QUAGLIERI, *Second Lieutenant, MSC, A. U. S.*

DISPOSAL of urine in semipermanent camps has long presented a problem in sanitation. The common urinal trough or pipe urinal is usually far from odorless and attracts flies and other insects. The following are a few of the special precautions which must be taken to insure the proper functioning of the urine-soakage pit: (1) men must not urinate on the pit itself; (2) the grass or straw in the funnels must be changed daily and the funnels cleaned with soap and water and changed when necessary; and (3) the pit must be kept free from oil or any other substance which might clog it.

To alleviate these problems, a special type of field urinal, the "Urinoil," was designed and constructed at this post. Urine in this urinoil is constantly covered with oil, thus furnishing no urine-contaminated surface which will attract flies. No cleaning is required. After the urinoil is installed, no maintenance is required, except to remove debris from the screen periodically to prevent clogging. The entire urinoil may be built from salvaged material.

Functioning of the urinoil. Because urine has a higher specific gravity than oil, it immediately disappears on striking the oil and flows directly to the bottom of the drum (fig. 1). The column of urine between the 3-inch and the 1½-inch pipe and the urine accumulated in the bottom of the drum supports the column of oil in the drum similar to a U-tube, one leg of which is filled with waste oil and the other with urine. The top of the urine column is at the 1-inch notch in the top of the 1½-inch pipe. The oil level is higher because of the difference in specific gravity of the urine and the oil. When additional urine is added, the urine overflows through the notch in the 1½-inch pipe and down through this pipe into the soakage pit. This overflow continues until the difference in specific gravity between the oil and the urine is equalized. The 3-inch pipe acts, much as a baffle in a grease trap, to prevent the oil from passing into the soakage pit.

Construction of the urinoil. The shell of the urinoil is a salvaged empty 55-gallon drum with the top removed. A hole is cut or burned through the bottom of the drum, large enough for the 1½-inch pipe, which is cut to the length shown in figure 1. One

(1) Fort Dix, N. J.

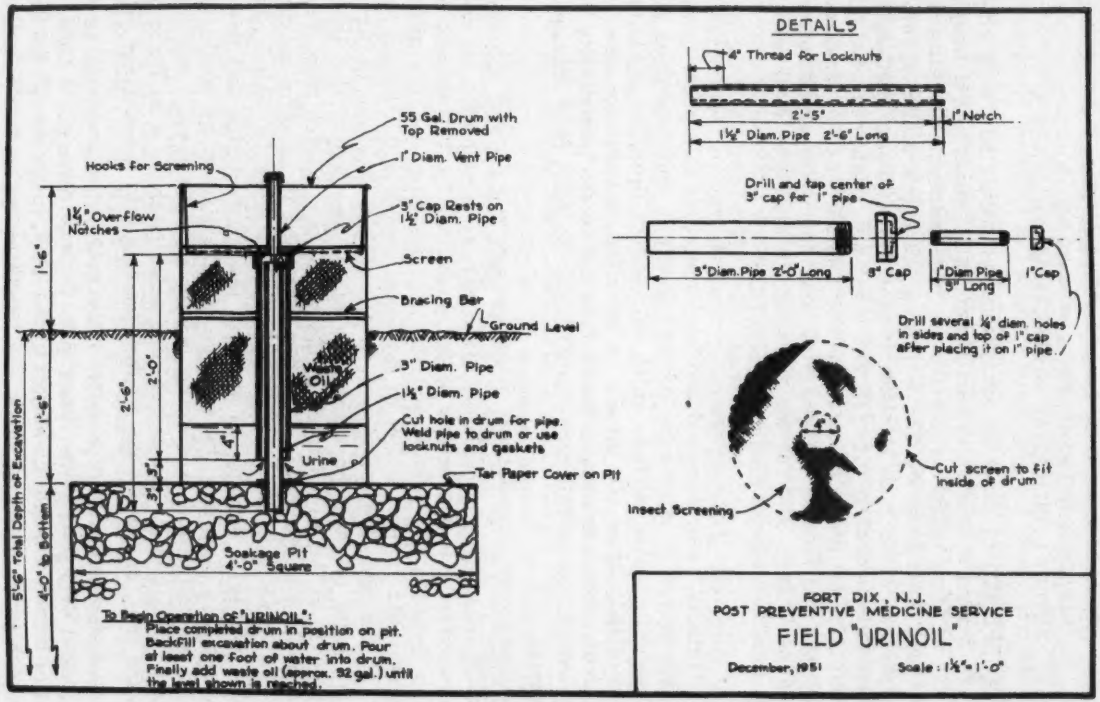
DETAILS
4" Thread for Locknuts
2'-5"
1" Notch
1½" Diam. Pipe 2'-6" Long
Drill and tap center of 3" cap for 1" pipe
5" Diam. Pipe 2'-0" Long
8" Cap
1" Diam Pipe 9" Long
1" Cap
Drill several ¼" diam. holes in sides and top of 1" cap after placing it on 1" pipe.
Cut screen to fit inside of drum
Insect Screening
55 Gal. Drum with Top Removed
1" Diam. Vent Pipe
Hooks for Screening
1¼" Overflow Notches
5" Cap Rests on 1½" Diam. Pipe
Screen
Bracing Bar
Ground Level
Waste Oil
5" Diam. Pipe
1½" Diam. Pipe
Cut hole in drum for pipe. Weld pipe to drum or use locknuts and gaskets
Urine
Tar Paper Cover on Pit
Soakage Pit 4'-0" Square
1'-6"
2'-6"
2'-0"
1'-6"
4"
5"
3"
5'-6" Total Depth of Excavation
4'-0" to Bottom
To Begin Operation of "URINOIL":
Place completed drum in position on pit. Backfill excavation about drum. Pour at least one foot of water into drum. Finally add waste oil (approx. 32 gal.) until the level shown is reached.
FORT DIX, N.J.
POST PREVENTIVE MEDICINE SERVICE
FIELD "URINOIL"
December, 1951
Scale: 1½"=1'-0"

Figure 1.

end of the pipe is notched 1 1/4 inches wide on both sides and 1 inch deep. If the notches are made more than 1 inch deep, the hydraulics will be disrupted and the oil surface will not adequately cover the screen. If welding equipment is available, the 1½-inch pipe should be welded to the bottom of the drum. If welding is impractical, the 1½-inch pipe must be threaded as shown in figure 1 and tightened with a lock nut and gasket inside and outside the bottom of the drum.

The 3-inch pipe is cut to the length shown in figure 1 and threaded on one end for a 3-inch cap which is drilled to receive a 1-inch pipe. The 1-inch pipe is cut to the length shown in figure 1 and threaded on both ends. One end is screwed into the 3-inch cap and a 1-inch cap is screwed on the other end. The 1-inch pipe acts as a breather pipe to eliminate siphonage of the urine and oil. The 1-inch cap must, therefore, be perforated with holes for constant assurance that the pressure under the 3-inch cap does not decrease, *otherwise siphonage will occur* and the entire contents of the drum will be drained into the soakage pit.

When the 3-inch pipe, 3-inch cap, 1-inch pipe, and 1-inch cap are assembled, the group *is set* over the 1½-inch pipe in the drum, the inside of the 3-inch cap resting on the top of the 1½-inch pipe. The system is made more stable if the end of the 1½-inch pipe is tack-welded to the 3-inch cap at the point of support. Bracing bars should be supplied as shown in figure 1 to support the pipes in a vertical position. The screening is then cut and wire hooks formed to support the screen.

Limitations. A urinal of this type has been installed in a training area at this post for 7 months. Its operation has been highly satisfactory. Its value in extremely cold climates is limited because there is danger of the urine freezing and clogging the pipes. The trial urinal was clogged once by freezing when temperatures ranged between 5° and 15° F. The urinal was used even though frozen and after a day's use and warmer weather the urine thawed. Subsequent intermittent cold spells had little effect.

After a heavy snowfall, a heavy oil and slush mixture has been found on the screen, but this in no way inhibits the functioning of the urinoil.

SUMMARY

The urinoil here described is a minimum-maintenance semipermanent urinal particularly suited to Army needs. Made of commonly salvaged materials, it can operate indefinitely, accommodating over 200 men. Although of limited value in extremely cold weather, the urinoil is simple and yet amazingly efficient.

BOOK REVIEWS

Fundamentals of Neurology, by *Ernest Gardner*, M. D., Professor of Anatomy, Wayne University College of Medicine, Detroit. 2d edition. 359 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., publisher, 1952.

This book is primarily for beginning students in neurology but nurses, physiotherapists, and those pursuing courses in zoology or psychology will find it most useful in the better understanding of neurologic patients. The neurologist, however, will find it worth reading. In a simplified manner, the basic concepts of all aspects of neurology are presented. The sections on nerve conduction, motor pathways, and cerebral cortex have been revised and are interestingly presented in the light of newer knowledge since publication of the first edition in 1947. The text is well written, the photographs are superb, and the diagrams are clear and uncomplicated. Each chapter is summarized and is followed by short biographies of one or several outstanding men in neurology whose fame is related to the subject matter just presented. Several references follow each chapter. Immediately preceding the index is a glossary of neurologic terms. This book is strongly recommended as an introduction to neurology and its allied fields.

—*Lt. Col. J. W. Sumner, MC, U. S. A.*

Textbook of Medicine, by various authors. Edited by *Sir John Conybeare*, K. B. E., M. C., D. M. (Oxon.), F. R. C. P., Physician to Guy's Hospital, London, and *W. N. Mann*, M. D. (Lond.), F. R. C. P., Assistant Physician to Guy's Hospital, London. 10th edition. 912 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publisher, 1952. Price $8.

This text on general medical subjects has maintained its simple, brief form in spite of 23 years of publication and 10 editions. It includes satisfactory discussion of such modern subjects as acceleration problems and, at times, reaches beyond the confines of internal medicine proper in the direction of pediatrics, psychiatry, and dermatology. In spite of wide subject coverage and an author's responsibility to repeat all the usual routine information which a student requires, the several collaborators have found space to include much advice on the art of medical practice. It is suggested, for instance, that the doctor warm his hands before examining an abdomen, that pains be taken to forewarn the diabetic patient of the possibility of local insulin fat atrophy, and that the invalidism which may result directly from the mere prescription of a diet may be more disabling than the disease being treated. This is a thoroughly effective effort to put basic information together in a readable way for the medical student. It is hoped that more effective illustrations will be provided in future editions.—*Lt. Col. E. D. Palmer, MC, U. S. A.*

OXYPOLYGELATIN AS A PLASMA SUBSTITUTE (1)

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OXYPOLYGELATIN (OPG) was first introduced by Pauling *(2)* in 1946. As an oxidized compound of polymerized gelatin fragments, it was claimed to be a better plasma substitute than gelatin itself. Literature concerning its use has been scanty *(3, 4)*. This report deals with some biochemical and clinical studies on OPG.

EXPERIMENTAL DATA

Method of preparation. OPG was synthesized according to Pauling's procedure. Difco gelatin was used as the starting material. The optimal amount of glyoxal used for coupling and of hydrogen peroxide for oxidation was found to be 0.025 gram of each per gram of gelatin. Determined according to its nitrogen content, the final saline solution was 5.4 percent (wt./vol.) in concentration, dark tan, with a pH of 6.4. Other gelatin solutions were prepared for comparison.

1. Plain gelatin solutions. Batches of 6 percent (wt./vol.) gelatin in normal saline solution were made up. These solutions, labelled PAG, RAG, and TAG, were autoclaved for 20 minutes at 15-lb. pressure once, twice, and 3 times respectively.

2. Oxidized gelatin (Oxy-G) solutions were prepared by adding 0.02 gram of hydrogen peroxide per gram of gelatin to PAG and autoclaving once to allow for oxidation.

Physical-chemical properties. Some of the physical and chemical properties of OPG and other gelatin solutions were determined (table 1). For comparison, the determination of Pauling's 11381Y preparation, Knox-P-20 clinical gelatin solution were also made and listed.

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(1) Department of Biochemistry, National Defense Medical Center and the Surgical Service, First Armed Forces General Hospital, Taipei, Taiwan, China.

(2) Pauling, L.: Final Report on Chemical Modification of Protein as Blood Substitute. 1946.

(3) McCarthy, M. D., and Parkins, W. M.: Comparative effectiveness of albumin, globin, hemoglobin, gelatin, oxypolygelatin, saline, Ringer's, blood and plasma upon survival of rats subjected to standardized scald burns. Am. J. Physiol. 150: 428-443, Sept. 1947.

(4) Koop, C. E.: Plasma substitutes. Am. J. M. Sc. 213: 233-240, Feb. 1947.

Our OPG solution had a lower osmotic pressure and relative viscosity than Pauling's preparation. Its molecular weight calculated from osmotic pressure was about 35,000 which is about one half that of human serum albumin. Unlike Pauling's, our OPG solution does not form gel at 5° C. These differences indicate that our OPG might differ from Pauling's in molecular structure because of a difference in either the basic material used; or to reaction conditions, or both. The successive autoclaving of PAG to turn it to TAG induced a significant increase in osmotic pressure and a decrease in relative viscosity without changing the fluidity of the product. After oxidation, however, the consistency of PAG was changed, i. e., the resultant Oxy-G was a

TABLE 1. *Physical-chemical properties of OPG and other gelatin solutions*

	Final protein concentration (percent)	Final pH	Osmotic pressure* (mm. H_2O)	Relative viscosity*	Consistency at 5° C.
PAG	6.0	7.2	26	1.35	gel
RAG	6.0	7.1	44	1.29	gel
TAG	6.0	6.8	47	1.26	gel
Oxy-G	6.0	6.4	43	1.20	semigel
OPG	5.4	6.4	78	1.18	sol
Re-OPG	5.4	7.2	234	1.13	sol
Knox-P-20**	6.0	7.2	96	1.35	gel
11381Y***	5.2	5.6	98	1.35	gel

*Determination was made on 1 percent solution at 37.5° C.
**Made in Knox Laboratory.
***Made in the California Institute of Technology.

semigel at 5° C. It was apparent, therefore, that a reduction in molecular size did not change the consistency of gelatin from gel to sol, but oxidation did. When OPG was reautoclaved after the final pH was adjusted from 6.8 to 7.2, Re-OPG resulted and showed marked increase in osmotic pressure and only slight decrease in relative viscosity. Because gelatin is readily hydrolyzed under high pressure sterilization, it was presumed that on reautoclaving there would be more chance for the molecular cleavage of OPG to take place at the peptide linkage than at the oxime linkage.

Physiologic experiments. The following experiments were designed primarily to evaluate the effectiveness of OPG in combating shock and in the maintenance of circulating volume after hemorrhage, the duration of retention in the circulation, pyrogenicity, and toxicity.

1. Pyrogenicity. The U. S. P. method of testing for pyrogens was

used, but instead of 3 rabbits, 4 (1 for control and 3 for testing) were used for each test. The test rabbits were given intravenous injections of 10 ml. per kg. body weight of various preparations and the control rabbit received no injection. The results are shown in table 2. OPG, Re-OPG, and Oxy-G gave no pyrogenic reaction, indicating that pyrogens could be destroyed during oxidation by hydrogen peroxide.

2. Maintenance of adequate blood pressure following hemorrhage. Rabbits of about 2 kg. body weight were anesthetized with ether and 20 ml. of blood per kg. body weight were removed from the left femoral artery. Signs of shock generally set in after from 40 to 50 ml. of blood had been withdrawn and could be effectively checked when an equal volume of OPG was given soon after its onset. The procedure was repeated under similar aseptic conditions on over 50 rabbits and no untoward reactions were observed during or after infusion. No deaths were recorded.

TABLE 2. *Pyrogenicity of different preparations*

	Temperature rise (degrees C.)		Interpretation
	Maximum	Average	
PAG	1.50	1.05	Pyrogenic
RAG	0.84	0.80	Pyrogenic
TAG	0.81	0.60	Pyrogenic
Oxy-G	0.44	0.21	Nonpyrogenic
OPG	0.33	0.27	Nonpyrogenic
Re-OPG	0.28	0.28	Nonpyrogenic
11381Y	0.10	0.18	Nonpyrogenic

Dogs were prepared for direct measurement of blood pressure by anesthetization with 0.3 gram of phenobarbital per kg. The carotid artery was cannulated for blood pressure tracing on a kymograph. From 20 to 25 ml. of blood per kg. body weight were then removed from the femoral artery. The hemorrhage was followed by replacement of an equal volume of OPG with good results. After a single massive hemorrhage (500 ml.) the diastolic pressure of dog 25 (fig. 1) dropped from 90 to 10 and the pulse rate became almost nil. Following an infusion of the same volume of OPG the diastolic pressure was raised promptly to about 130. It was also found that the stroke volume of the heart, as indicated by the amplitude, was increased by OPG. Similar results were obtained with dog 21.

3. The fate of OPG after infusion. Rabbits were placed in metabolic cages and allowed to take about 3 grams of nitrogen daily on a stock diet and distilled water as desired. Urine and feces were collected

every other day instead of daily in order that wide differences in daily urine volume might be minimized. A few crystals of thymol were put into each urine receiver as an antiseptic. One volume of 10 percent sodium tungstate solution and 4 volumes of 2N/3 sulfuric acid were used to precipitate urinary protein from 5 volumes of urine. The non-protein nitrogen in the supernatant fluid was determined to check the degree of accuracy of protein nitrogen values obtained from the precipitate after resolution in alkali. The micro-Kjeldahl method was used in all nitrogen determinations. After establishment of a positive nitrogen balance for 2 days, each rabbit was given an intravenous dose of 10 ml. of OPG per kg. body weight. The collection of urine and feces continued until the nitrogen values returned to the basal levels. The whole experiment took 14 days. Six rabbits, including 2 controls, were used for each experiment.

The average urinary excretion of protein nitrogen in 2-day periods of the 4 control rabbits which received no OPG injection was 12.72 mg. (range 4.81 to 20.94 mg.).

Table 3 shows the excretion of OPG expressed in protein nitrogen in the test rabbits. During the control period, the protein nitrogen excreted varied from 2.52 to 31 mg. (average 14.94 mg.) per 2-day period, comparable to the corresponding value for the control rabbits. After an injection of OPG, the rabbits excreted on the average 36.18 percent of the OPG in the first 2 days, 23.76 percent in the next 2 days, gradually leveling off in from 6 to 10 days. The total excretion of OPG varied from 46.95 percent to 103.52 percent of the amount injected (mean 73.93 percent), indicating that OPG remains in the circulation for several days before its complete disappearance. A large part (73.93 percent) of the injected OPG was probably excreted unchanged. Whether the remaining 26.07 percent was retained in the circulation or was utilized is not known at present.

The test rabbits often showed a significant increase of amino nitrogen excretion after OPG injection. Because all the rabbits gained weight during the course of the experiment, no evidence of tissue damage was found in the toxicity experiment and, because of the possible presence of a proteolytic enzyme in the serum as reported recently (5), we must consider the possibility of the utilization of OPG after intravenous injection. The excretion of amino nitrogen from both test and control animals showed such wide variations that no definite conclusions could be drawn.

4. Toxicity. Two rabbits (no. 3 and 4) were sacrificed after weekly injections of 10 ml. of OPG per kg. for 6 weeks. Gross and microscopic examinations of internal organs, including the heart, lungs, liver, kidney, and spleen, showed nothing significant, nor was any storage effect discerned. Another rabbit (no. 11) was given OPG 3 times within a week

(5) Cliffton, E. E., and Cannamela, D. A.: Variations in proteolytic activity of serum of animals including man. Proc. Soc. Exper. Biol. & Med. 77: 305-308, June 1951.

by mistake and it died of heart failure. Microscopic study of its internal organs revealed venous congestion. Because the metabolic study showed that about 60 percent of the OPG remained in the circulation 3 days after injection, it may be surmised that the death of this rabbit was the direct result of an overburdening of the heart rather than of any toxic effects of the OPG.

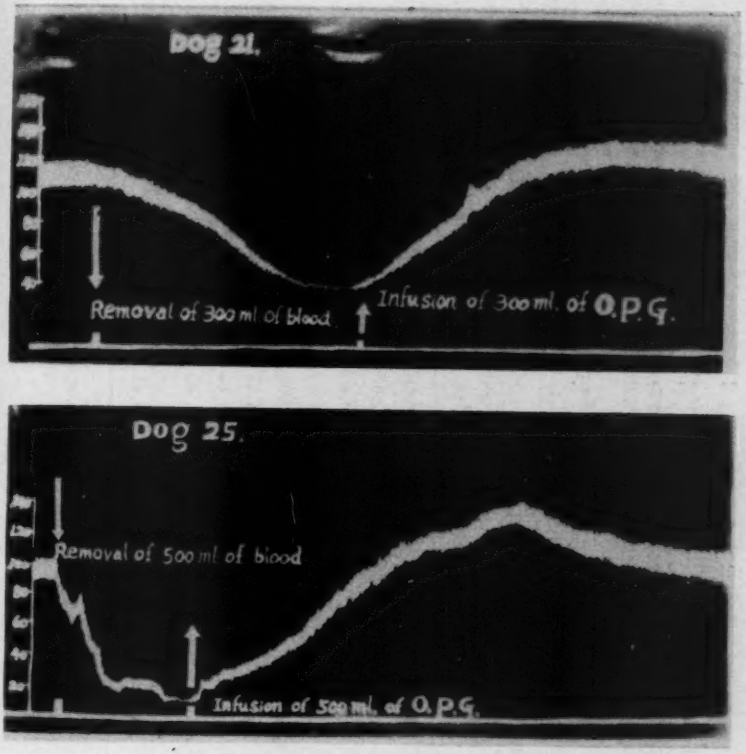

Figure 1. Kymograms of continuous blood pressure measurement on 2 dogs treated with OPG after a single massive hemorrhage.

CLINICAL TESTS

Eight patients on whom chest or abdominal operations were performed were given from 500 to 1,000 ml. of OPG at a rate of from 5 to 10 ml. per minute either during or after operation. There was no untoward reaction either during or 24 hours after the infusion. The data obtained are shown in table 4.

Reaction and temperature. With the exception of patients 6 and 7, who showed an increase of body temperature 6 hours after infusion, and patient 5, who showed an increase 12 hours after infusion, none of

TABLE 3. *Urinary excretion of OPG expressed as protein-nitrogen*

Rabbit number	(1) Urinary protein nitrogen excretion in 2 days before OPG injection (mg.)	(2) OPG injected in terms of protein nitrogen (mg.)	(3) Excretion of urinary protein nitrogen (mg.)				
			Days after OPG injection				
			1-2	3-4	5-6	7-8	9-10
5	23.00	172.8	93.00	69.00	35.00	14.2	-
17	6.72	198.6	102.00	60.00	22.00	22.8	-
1	19.40	182.0	71.60	63.20	34.40	28.8	25.20
6	16.20	172.8	84.80	54.60	18.80	15.2	-
19	9.28	190.0	101.00	36.00	7.20	11.8	-
9	31.00	147.0	59.40	64.40	36.80	50.0	41.20
28	2.52	190.0	79.34	79.34	45.50	3.0	-
27	11.40	190.0	58.00	36.40	24.80	15.0	12.00
Mean	14.94	180.4	81.14	57.87	28.06	20.1	26.13

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TABLE 3. *Urinary excretion of OPG expressed as protein-nitrogen*—Continued

(4) Excretion of urinary protein nitrogen presumably due to OPG injection in corresponding 2-day periods* (mg.)										(5) Total excretion of OPG in terms of protein nitrogen**	
1-2		3-4		5-6		7-8		9-10		Mg.	Percent
Mg.	Percent	Mg.	Percent	Mg.	Percent	Mg.	Percent	Mg.	Percent		
70.00	40.51	46.00	26.62	12.00	6.94	-	-	-	-	128.00	74.07
95.28	47.98	53.28	26.83	15.28	7.69	16.08	8.10	-	-	179.92	90.60
52.20	28.68	43.80	24.07	15.00	8.24	9.40	5.16	5.80	3.19	126.20	69.34
68.60	39.70	38.40	22.22	2.60	1.50	-	-	-	-	109.60	63.42
91.72	48.27	26.72	14.06	-	-	2.52	1.33	-	-	120.96	63.66
28.40	19.32	33.40	22.72	5.80	3.95	19.00	12.93	10.20	6.94	96.80	65.86
76.82	40.43	76.82	40.43	42.98	22.62	0.08	0.04	-	-	196.70	103.52
46.60	24.53	25.00	13.16	13.40	7.05	3.60	1.89	0.60	0.32	89.20	46.95
66.20	36.18	42.93	23.76	13.38	7.42	6.34	3.51	5.53	3.06	138.46	73.93

*Values in mg. are based on excess of urinary protein nitrogen over the control value (column 1). Percentages express proportions of protein nitrogen excreted in relation to the amounts of OPG originally injected (column 2).

**Totals in each row are the sums of the values in column 4. The two means in mg. and percentage are calculated in the same way and not by averaging the vertical values in column 5 because of uneven distribution of values.

TABLE 4. *Clinical observations on a group of patients who received OPG (1)*

Time	Before infusion	Hours after infusion			
		1	6	12	24
Patient 1 *(2, 3)*					
Temperature C. (rectal)	38.3	38.3	38.4	38.5	38.3
Pulse rate	100	99	98	97	96
Respiration	24	25	24	24	23
Blood pressure	100/70	105/74	104/78	110/80	112/82
Erythrocyte count (million)	3.5				3.7
Patient 2 *(4, 5)*					
Temperature C. (rectal)	37.0	37.6	37.4	37.4	37.6
Pulse rate	80	94	94	84	96
Respiration	16	18	18	18	18
Blood pressure	110/70	120/80	130/90	130/90	140/98
Erythrocyte count (million)	4.2	4.2	4.0	4.2	4.4
Patient 3 *(2, 6)*					
Temperature C. (rectal)	39.4	39.4	39.3	39.0	
Pulse rate	145	130	124	124	
Respiration	26	23	24	24	
Blood pressure	88/55	100/60	108/68	108/62	
Erythrocyte count (million)					
Patient 4 *(4, 7)*					
Temperature C. (rectal)					
Pulse rate	68	90	98		86
Respiration			27		24
Blood pressure	98 (sys)	90 (sys)	110/60		110/60
Erythrocyte count (million)	4.0		4.27		4.39
Patient 5 *(2, 8)*					
Temperature C. (rectal)	36.8	37.0	36.6	38.0	38.2
Pulse rate	74	85	130	120	120
Respiration	30	42	40	48	40
Blood pressure	114/72	120/80	125/80	115/76	130/84
Erythrocyte count (million)	4.3	4.0	4.0	4.0	4.0

TABLE 4. *Clinical observations on a group of patients who received OPG (1)*—Continued

Time	Before infusion	Hours after infusion			
		1	6	12	24
Patient 6 *(2, 9)*					
Temperature C. (rectal)	37.0	37.0	38.0	38.0	38.0
Pulse rate	70	80	110	80	77
Respiration	28	30	32	30	24
Blood pressure	106/64	110/70	120/70	100/68	90/64
Erythrocyte count (million)	3.5	3.0	3.0	4.0	3.4
Patient 7 *(2, 10)*					
Temperature C. (rectal)	37.7	37.7	38.0	38.0	38.2
Pulse rate	80	100	90	84	80
Respiration					
Blood pressure	106/80	110/80	120/78	130/80	120/78
Erythrocyte count (million)	4.0				3.9
Patient 8 *(2, 3)*					
Temperature C. (rectal)	38.2	37.5	37.2	37.4	37.4
Pulse rate	95	99	110	102	104
Respiration	26	26	25	26	26
Blood pressure	110/70	115/80	110/80	110/84	112/82
Erythrocyte count (million)	3.8				3.8

(1) No patients showed any skin changes, disorientation or other adverse effects.
(2) Infused with 500 ml. of OPG.
(3) Male; had choledocholithiasis.
(4) Infused with 1,000 ml. of OPG.
(5) Male; had postureteral sigmoid anastomosis.
(6) Male; had retained foreign body in lung.
(7) Male; had biliary obstruction with cholangitis.
(8) Male; had lung cyst.
(9) Female; had neoplastic stricture of descending colon.
(10) Female; had acute generalized peritonitis.

the patients showed temperature changes. These 3 patients complained, however, of no subjective discomfort, feverishness, dizziness, or chilliness. The increase in temperature varied from 0.8° to 1.2° C. which could have been due to postoperative reaction or normal fluctuation *(6, 7)*.

(6) Best, C. H., and Taylor, N. B.: The Physiological Basis of Medical Practice. 4th edition. Williams & Wilkins Co., Baltimore, Md., 1945. p. 623.

(7) Chang, H. L.; Chen, J. S.; Chiang, C. H.; Chen, M. L.; and Yue, J. C.: Dextran infusion in normal Chinese men. Armed Forces M. J. 2: 341-352, Mar. 1952.

Pulse and respiration. There was in general no abnormal change in the pulse and respiratory rates following OPG infusion. The pulse and respiratory rates of patient 5 increased from 74 to 130 and from 30 to 48 respectively. This patient had a thoracotomy and the infusion was given during the operation. One of us (ASC) considered the increase as probably a direct effect of the operation itself.

Blood pressure. Patient 6 was exceptional in that his systolic pressure rose following infusion, then fell to levels below the pre-infusion level. The average increase in blood pressure after OPG infusion, however, was 16.6 (range 5 to 30). The increase was sustained during the 24-hour period of observation after infusion. The amount of OPG infused as against the amount of blood lost during operation would be an important factor in determining the extent and duration of blood pressure elevation.

Erythrocyte count. The drop of erythrocyte level, hemoglobin content, and hematocrit readings following infusion of dextran *(7, 8)* and human serum albumin *(9)* is generally known. In the present series, 3 patients showed a slight increase in erythrocyte count after infusion. The same was observed in experimental rabbits. Although gelatin is known to increase plasma protein and hemoglobin levels when given by mouth *(4, 10, 11)*, it is not certain whether the present finding, if significant, could be the result of direct utilization of OPG or of its indirect effect.

Urinary excretion of sugar and protein. Qualitative tests on urinary sugar and protein were performed before and after infusion. In no case was sugar found in the urine after infusion. It was anticipated that OPG would be excreted to some extent through the kidneys and a slightly positive test for protein was observed in the urine of most of our patients only when 10 percent sodium tungstate solution and 2N/3 sulfuric acid were used as the protein precipitant.

SUMMARY

Oxypolygelatin was prepared in this laboratory according to Pauling's technic. Mainly because of its fluidity, our OPG did not form gel at 5° C. as was the case with Pauling's preparation. OPG has an average

(8) Thorsen, G.: On Dextran. Lecture given before the Swedish Medical Society, May 24, 1949.

(9) Janeway, C. A.: Clinical use of products of human plasma fractionation; albumin in shock and hypoproteinemia; gamma globulin in measles. J. A. M. A. 126: 674-685, Nov. 11, 1944.

(10) Robscheit-Robbins, F. S.; Miller, L. L.; and Whipple, G. H.: Gelatin—its usefulness and toxicity; blood protein production impaired by continued gelatin by vein. J. Exper. Med. 80: 145-164, Aug. 1944.

(11) Robscheit-Robbins, F. S.; Miller, L. L.; and Whipple, G. H.: Hemoglobin and plasma protein production; various proteins, concentrates, and digests influence blood protein production in anemia and hypoproteinemia. J. Exper. Med. 83: 463-475, June 1946.

molecular weight of 35,000. A 1 percent aqueous solution at 37.5° C. has a relative viscosity of 1.18 and an osmotic pressure of 78 mm. of water. A 6 percent solution in physiologic saline solution has a pH value of 6.8 and is dark tan. The solution is not pyrogenic and shows no toxic effect on repeated use. OPG is effective in restoring circulating volume and in sustaining blood pressure after hemorrhage. About 70 percent of the OPG injected into the circulation is eliminated through the urine within 10 days after infusion. The retention is long enough for the regeneration of lost blood protein. Whether or not the remaining 30 percent is utilized in the body is not known. Clinical trials on 8 surgical patients showed no untoward reaction on administration of from 500 to 1,000 ml. of OPG intravenously either during or after operation. Favorable effects on the blood pressure, pulse rate, and respiration were obtained. A slight increase of erythrocyte count was noted in some of the patients.

BOOK REVIEWS

Spatial Vectorcardiography, by *Arthur Grishman,* M. D., Adjunct Physician for Cardiology, The Mount Sinai Hospital, New York; Adjunct Physician in Medicine and Assistant Roentgenologist, Beth Israel Hospital, New York; Former Adjunct Attending Physician in Medicine and Assistant Roentgenologist, The Montefiore Hospital, New York, and *Leonard Scherlis,* M. D., Research Assistant in Cardiology, The Mount Sinai Hospital, New York. 217 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., publisher, 1952.

This monograph consists basically of the material previously published in a series of articles in the American Heart Journal under the same authorship. As spatial vectorcardiography and the vector concept of electrocardiography are in the formative stages and not sufficiently developed for routine clinical use, this monograph serves primarily as a reference for the small group interested in research in this new field of cardiology and, possibly, as an aid to those in clinical medicine who may be sufficiently proficient to use spatial vectorcardiography as an adjunct to clinical electrocardiography. At most, it presents only a concept and approach because there is as yet no standardization of technics, procedures, and interpretation in spatial vectorcardiography. The various investigators in the field have not reached an agreement as to the placement of leads, the body planes to be represented, or the method of viewing the composite loop.

The authors use the cube technic of electrode placement and record the electromotive forces in horizontal, sagittal, and vertical planes. This technic does not require stereoprojection or construction of model loops to obtain spatial orientation of the vector loop.

The book includes an extensive bibliography and an index. It is profusely illustrated and a uniform system of vector and electrocardiographic photography is used throughout. The clarity of presentation makes this monograph more readable and understandable than other publications on the same subject. The authors have failed to indicate the basis for the diagnosis of myocardial infarction, ventricular hypertrophy, and the differentiation between ventricular hypertrophy and bundle branch block. The representative cases used in a publication demonstrating correlative findings with clinical electrocardiography and attempting to establish diagnostic criteria for vectorcardiography should use only instances in which the pathologic diagnosis has been established by autopsy. If this was done, no mention was made of it.

—*Col. T. W. Mattingly, MC, U. S. A.*

Circulatory Dynamics, Physiologic Studies, by *Carl J. Wiggers,* M. D., Sc. D., F. A. C. P., Professor of Physiology and Director, Department of Physiology, School of Medicine, Western Reserve University, Cleveland, Ohio. Modern Medical Monographs, No. 4. 107 pages; illustrated. Grune & Stratton, Inc., New York, N. Y., publishers, 1952. Price $4.

The author has recast certain lectures dealing with experimental aspects of circulatory dynamics into book form with the thought that such a collection would be useful to investigators and progressive practitioners having concern with human circulatory dynamics. This objective is amply fulfilled. This monograph deals first with hemodynamic laws; and analysis of the practical information which can be gained from arterial pressure readings and arterial pulse registrations plus illustrations of how such information increases understanding of the dynamics of hypertension. The second section deals with the mechanisms by which the ventricles adapt to altered circulatory states in health and disease. The last section is devoted to interpretations of ventricular contraction patterns by analysis of ventricular pressure curves. The author discusses the alterations which take place as a result of pericardial effusion, hypervolemia, oligemia, arterial hypertension, aortic coarctation, aortic and pulmonary stenosis, idioventricular rhythms, ventricular alternation, coronary occlusion, myocardiac ischemia, and valvular lesions.—*Lt. Col. F. L. Bauer, MC, U. S. A.*

PLASTIC CLOSURE OF ORO-ANTRAL FISTULA

EDWARD C. RAFFETTO, *Captain, DC, U. S. N. (1)*

THE maxillary sinus is occasionally involved by the extraction of teeth or procedures for the removal of fractured roots as the floor of the sinus is sometimes in close relationship to the apexes of the maxillary molars and premolars. Patients with oro-antral fistulas are frequently referred to the dental service for plastic repair. A satisfactory method of plastic closure is presented in the following case report.

CASE REPORT

A 40-year-old man had the first and second maxillary right molars removed on 6 September 1951. Immediately following the extractions, an operation to close the defect was performed by suturing the soft tissues buccopalatally but it was unsuccessful. The patient was seen in consultation on 20 November. The maxillary right posterior teeth were missing and an oro-antral fistula was present in the area of the first molar. An opening about 8 mm. in diameter was present with granulationlike tissue prolapsing through the fistula. The patient's chief complaint was the passage of air and, occasionally, of fluids from the mouth into the antrum and out the nose.

The patient was admitted to the hospital on 3 December at which time physical examination was essentially negative except for the communication between the right maxillary sinus and the oral cavity. There was no pain and no evidence of suppuration. Roentgenograms of the sinus area showed no evidence of root fragments or foreign bodies. The granulationlike tissue prolapsing from the opening prevented air from passing freely on forceful exhalation against closed nostrils. A large aspirating needle was inserted through the opening into the sinus and the patient was again asked to exhale against his tightly held nostrils. Air passed freely through the needle, indicating a patent ostium and probably a clean antrum. A maxillary impression was taken and a study model made on which was constructed a clear acrylic full-palate splint.

Roentgenographic examination of the paranasal sinuses showed cloudiness of both maxillary antrums with mucosal thickening along the inferior lateral sinus wall. The other sinuses appear clear and well aerated. The findings were consistent with a chronic maxillary sinusitis.

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The rhinologist saw the patient, found no evidence of a purulent discharge, and advised against an antronasal opening. A plastic closure was decided on. The patient was given 300,000 units of penicillin daily. The full-palate acrylic splint was placed in position and was found to fit satisfactorily. The splint was relieved over the area covering the proposed flap. The patient was given 10 mg. of morphine sulfate and 100 mg. of pentobarbital 1 hour prior to operation. The remaining teeth were cleaned and the mouth sprayed with an alkaline mouthwash and irrigated with normal saline solution. The following injections of a solution containing 2 percent lidocaine and epinephrine in a dilution of 1:50,000 were made: (1) posterior palatine, (2) anterior palatine, (3) tuberosity, and (4) infiltration of buccal areas.

The margins of the fistula were excised by making a circular incision about 3 mm. from the opening. By means of mosquito forceps and curets, all granulation tissue was removed through the fistula. The forceps were extended through the opening into the lower section of the antrum and as much fragile granulation tissue as possible was removed.

The flap was designed. The palatal mucosa was incised down to the bone. Starting to the right of the median line opposite the second molar area the incision was extended forward to the cuspid area, curving around to make the flap about 1 cm. in width, and was extended back to the second molar area. The flap was carefully detached to include the periosteum. The small section of palatal mucosa adjacent to the fistula was removed and the mucosa on the buccal side of the opening was undermined with a periosteal elevator to facilitate the placement of the flap. A small section was cut on the lesser curvature to prevent folding of the flap as it was turned. The flap was placed in contact with the recipient area and was found to cover the opening. It laid in good relationship to the adjacent tissue, and was secured in position by means of seven 0000 nylon interrupted sutures. The acrylic palatal splint was inserted and no pressure points could be seen on the palatal flap. It was not necessary to insert gauze packing in the donor site.

Bed rest was prescribed for the first 48 hours after operation. Liquid diet was given for the first week. The patient was allowed 100 mg. of demerol every 4 hours if needed. An ice pack was placed on the right side of his face for 25 minutes every hour for the first 6 hours after operation. Nose drops containing 1 percent ephedrine sulfate were instilled in his nostrils every 6 hours. He was instructed to rinse his mouth gently with a saline mouthwash after each meal. He was advised not to smoke or exert any suction in the oral cavity, and not to blow his nose. A bloody nasal discharge was present for the first 7 days, especially in the mornings. The palatal splint was removed and cleaned daily after the third postoperative day. The sutures were removed on the ninth postoperative day. The patient was discharged to duty on 21 December and was instructed to wear the palatal splint for another 2 weeks. He was asked to continue to avoid sucking action and was started on a soft diet. Three weeks later the area was completely healed.

The use of a clear acrylic splint following closure of an oro-antral fistula by plastic repair is worthy of consideration. Healing seems to progress without complication and there is no need for placing a packing in the donor site. It is essential that the ostium of the sinus be open for proper ventilation of the antrum or an antronasal window made prior to closure of oro-antral fistula. Definite and detailed postoperative instructions to the patient are necessary.

BOOK REVIEWS

Cunningham's Text-Book of Anatomy, edited by *James Couper Brash,* M. C., M. A., M. D., D. Sc., F. R. C. S. Ed., F. R. S. E., Professor of Anatomy, University of Edinburgh. 9th edition. 1,604 pages; illustrated by 1,252 text figures, 699 of which are printed in colors, and 88 plates including 145 radiographs. Oxford University Press, New York, N. Y., publisher, 1951. Price $14.

This new edition is invaluable, not only for the undergraduate medical student and those engaged in teaching, but also for the practicing physician who desires a ready reference in anatomy. The editors have made every effort to improve this edition by revision of certain sections, by better and more illustrations, and by including new material. Free use of colored illustrations, diagrams, and radiographs enhance the value of this work. The content is well set forth with both a complete table of contents and an adequate index. The extensive bibliography at the end of each section is a distinct improvement. The recency of some of the references makes the reader realize that there is yet much to learn in the field of anatomy. Finally, the print is excellent and the volume is well constructed.

—*Col. P. S. Fancher, MC, U. S. A.*

Living in Balance, by *Frank S. Caprio,* M. D. 246 pages. The Arundel Press, Inc., Washington, D. C., publisher, 1951. Price $3.75.

Although this worth-while book was written primarily for the lay person, many of the author's views will interest psychiatrists and other professional workers in the field of mental health. Due to popular demand and interest, there has been a deluge of publications on psychiatric subjects, many of which are the work of poorly qualified and ill-informed writers. Dr. Caprio's book is an outstanding exception. The author has presented, with unusual clarity, the recognized concepts of the various neurotic mechanisms and their impact on normal living.

His approach begins, quite appropriately, with a concept of the normal personality and what might be considered to be the healthy adjustment to living. He then continues with an interesting explanation of the various neurotic disorders in a fashion designed to appeal to the reader whose previous understanding and knowledge of such material has been limited. Several chapters devoted to the marriage relationship may well serve to dispel certain existing confusions in the minds of marital partners. Special problems of living, such as alcoholism and suicide, are discussed in a manner designed to give understanding and reassurance to the distressed. A chapter entitled, "First Aid for Mental Injuries" is unique, as is the one entitled, "A Chart to Happiness," both designed to give the reader some degree of insight into his problems and to assist him to achieve a balanced life.—*Lt. Col. C. T. Brown, MC, U. S. A.*

New and Nonofficial Remedies, Containing Descriptions of the Articles Which Stand Accepted by the Council on Pharmacy and Chemistry of the American Medical Association on January 1, 1952. Issued under the Direction of the *Council on Pharmacy and Chemistry, American Medical Association.* 838 pages. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1952. Price $3.

This book is an annual publication of the Council of Pharmacy and Chemistry of the American Medical Association. The 1952 edition contains articles found acceptable through 1 January 1952. Drugs are not automatically considered for acceptance when they become commercially available, but must be submitted for consideration by the interested pharmaceutical manufacturers.

The book is divided into two major sections. Section A consists of short monographs describing the actions, uses, and dosage of individual drugs. These articles are arranged according to broad therapeutic classifications. Section B consists of tests and standards for accepted drugs or dosage forms not official in the U. S. P. or N. F. The arrangement is alphabetical according to generic names. Articles which have been accepted for 20 or more years are not described in Section A, but tests and standards for unofficial drugs are included in Section B. The book is provided with a bibliographic index of unaccepted products and a general index. The general index includes references to the most recent edition of New and Nonofficial Remedies which describes accepted products not included in the 1952 edition.

This book is an essential part of the pharmacist's library. It should be readily available to all physicians.

—*Capt. J. W. McNamara, MSC, U. S. A.*

COMMON CAUSES OF PAIN ABOUT THE JAWS

ROBERT L. PEKARSKY, *Captain, DC, U. S. A.*

THE soldier reporting to the dentist often points vaguely to an area of his face and says, "The pain is about in here." The treatment of such a patient in the combat zone of Korea can be a difficult problem. In spite of the limited equipment available, a correct diagnosis can be made and the condition successfully treated in an evacuation hospital through the use of the portable x-ray machine and the instruments supplied in Chests 60 and 61.

I usually start by trying to get the patient to localize the pain more exactly, then I ask how long he has had the pain. If he has had it on and off for several years but it has suddenly become worse in the preceding 3 weeks, I ask how long he has been in the Army and how long he has been overseas. If he answers, "Three weeks," it is more than likely that he is an unstable person and as such that he has a lower threshold of reaction to pain than a more normal person. The patient is then asked whether he has a toothache along with the pain in the jaw. If he says, "Yes," you can usually discover the offending tooth and decide whether to fill or extract it.

It should be determined whether the patient has been in any fights, fallen, or been in an accident recently and whether he has a feeling that his teeth do not come together properly. If the reply is, "Yes," a radiographic examination of the jaws should be done because the patient may have a fractured maxilla or mandible, causing a malocclusion. He should be asked whether he has any difficulty opening his mouth or in swallowing. The presence of trismus will suggest the presence of edema in the lateral pharynx, masseter, or internal pterygoid muscles, originating from an unerupted and impacted third molar. He should also be asked whether he has had any swelling of his face recently. Since the advent of the antibiotics, physicians sometimes have been inclined to use these drugs on the slightest provocation. As a result, an early acute infection that has been treated with an antibiotic may subside, but remains as a chronic low grade infection, producing pain and making the diagnosis difficult. In any patient with pain about the face or jaws, the cervical nodes should be felt for tenderness or enlargement.

COMMON CONDITIONS CAUSING PAIN IN THE JAWS

One of the most frequent causes of pain in the jaws is dental caries. Pain may be referred from regions other than the one on which the pa-

tient focuses. If the tooth is the offender, an injection of procaine around it should relieve the pain.

The second most frequent cause of pain in the jaw among our troops is an impacted and unerupted upper or lower third molar. Pain in the area anterior to the auricle can be produced by an unerupted or carious upper third molar. Pain in the external auditory meatus, parotid region, or in the submaxillary region may be referred from mandibular third molars. The observation of inflamed gingival tissue or subgingival pyogenic infection created by the erupting tooth will make the diagnosis easy. The pain threshold is known to be lowered in inflamed tissues.

Pain in the region of the temporomandibular joints or in the ear can be caused by disturbances in neighboring structures (a middle ear infection or a subcutaneous abscess in the external auditory meatus). Such local conditions as subluxation of the temporomandibular joint or chronic traumatic arthritis of the temporomandibular joint may also cause pain. Subluxation is associated with a clicking or snapping noise that can be heard as the patient's mouth opens with a jumping motion. The noise is due to the condyle of the mandible striking the bony articular eminence. In some cases, the jaw catches due to displacement of the meniscus. The subluxation often results from minor injuries which cause weakness of the joint capsule or ligaments. When a temporomandibular joint disturbance is suspected, a good roentgenologic study of this region is of the utmost importance.

In treating a subluxation, the motion of the jaw should be limited for 6 or 7 weeks by intermaxillary wiring. If, after this period, the symptoms return, injection of the temporomandibular joints with intracaine or sodium psylliate, as recommended by Schultz *(1)*, usually gives relief.

Artillery men participating in long periods of continuous firing frequently complain of pain in the preauricular areas. I believe this is often due to the habit some soldiers have of clenching their teeth or tightening their jaws at the time of firing. This habit could produce an irritation of the articular disk of the temporomandibular joint.

The presence of a malocclusion may predispose to chronic temporomandibular arthritis. The patient complains of noise in the temporomandibular joint during chewing; various forms of neuralgia, such as headaches, pain behind the ear, or in the mouth or jaws; and a burning sensation or pain in the tongue. If, when the patient bites firmly on a tongue depressor with his molars, there is relief of the pain, occlusal rehabilitation of the teeth will alleviate the condition.

A soldier suffering from maxillary sinusitis may complain of fullness and pressure that was followed by agonizing pain or intermittent and neuralgic pain in the maxillary region. The teeth in his upper jaw are tender and painful, and the pain is often referred to the ear, orbit, or

(1) Schultz, L. W.: Treatment for acute and chronic temporomandibular arthritis. New York J. Dent. 11: 350, 1941.

forehead. In making the differential diagnosis, it should be remembered that infection in the maxillary sinus is often associated with a history of influenza or common cold.

CONCLUSION

In determining the cause of pain about the jaws, a careful history, including knowledge of the soldier's military occupation, and a radiographic examination are of prime importance. Knowledge of the pathways of the trigeminal nerve and the facial nerve will enable one to trace a vague pain to its source.

BOOK REVIEWS

Tubercle Bacillus and Laboratory Methods in Tuberculosis, by *M. A. Soltys*, Ph. D., D. M. Vet., Lecturer in Bacteriology (School of Veterinary Science), University of Liverpool, in collaboration with *C. A. St. Hill*, M. B., Ch. B., Consultant Pathologist to the Royal Southern Hospital and Lecturer in Clinical Pathology, University of Liverpool, and *I. Ansell*, M. D., M. R. C. P., Consultant Physician to the Liverpool Chest Hospital. 212 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publisher, 1952. Price $4.50.

Rarely does one find so much factual information about a single subject concentrated into so small a volume and between the covers of a single book. This represents a highly successful attempt to review the vast literature on the tubercle bacillus in a concise manner. Part 1 reviews the tubercle bacillus as a living entity of scientific interest. Statements of both fact and controversy are somewhat abrupt because of the brevity of presentation. The few occasions where the authors do present details tend to surprise the reader who has become accustomed to the rapidity of presentation. Although controversial points of view are presented, the authors make no attempt to influence the reader's opinion. Part 2 thoroughly and in some detail covers every possible phase of successfully diagnosing tuberculosis in the laboratory. Numerous variations in each of the many laboratory procedures are described and briefly evaluated. No possible present-day avenue of approach has been neglected.

The number of persons this book will interest is limited. The clinical pathologist and the clinical bacteriologist will find it a valuable source of information on methods and procedures. To the interested investigator, it makes quickly available a vast amount of original literature because each statement of fact is

well documented with references. All sources are clearly and concisely indicated at the end of each chapter. Printed in Great Britain, the book forgoes the luxury of more than the essential plates, tables, and figures.

—Lt. Col. J. M. Hale, U. S. A. F. (MSC)

Psychiatry and Catholicism, by *James H. VanderVeldt,* O. F. M., Ph. D., Associate Professor of Psychology, Catholic University of America; Professor of Psychology, Trinity College, and *Robert P. Odenwald,* M. D., F. A. P. A., Director of the Child Center and Assistant Professor of Psychiatry, Catholic University of America. 433 pages. McGraw-Hill Book Co., Inc., New York, N. Y., publishers, 1952. Price $6.

This is a book on a controversial subject which has been given considerable publicity and generated much heat. Written by professors of clinical psychology and psychiatry at Catholic University, with a foreword by the Archbishop of Washington, it may be considered as the semiofficial Catholic viewpoint. If the reader is willing to accept the authors' implicit assumption that the Catholic viewpoint is *the* Christian one, he may read this well-written work with equanimity. The authors claim to have no bias against dynamic psychiatry as such, and give Freud due credit, but they do strongly disagree with what they call the "materialistic, deterministic, and hedonistic philosophy" developed by the orthodox Freudian analysts. To quote: "One is frequently unable to find out what is fact, what is psychological theory, and what is philosophical assumption in his writings." Instead they find the existential analysis championed by Frankel more in agreement with their beliefs. "Whereas psychoanalysis is only concerned about making the unconscious id conscious, existential analysis aims at bringing to the conscious level something very different—man's own spiritual existence."

The first part of the book discusses the general principles of dynamic psychiatry assessed by Catholic morality. In the latter portions, the various psychiatric disorders and the implications of psychiatric knowledge in twentieth century living including social work, marriage counseling, and sex education, are discussed. Because the book seems intended primarily for the Catholic clergy and other Catholics working with the mentally ill, pastoral problems are discussed at length. This volume does an excellent job of acquainting such persons with modern developments in psychiatry and should alleviate the prejudices of those who consider any psychiatric approach antithetical to religion. For the non-Catholic it explains the position of those working in the Catholic Church. The book is well printed in an attractive, easily read format.

—Commander F. H. Ocko, MC, U. S. N.

DIVERTICULUM OF THE DUODENUM[1]

EVERETT H. DICKINSON, *Captain, MC, U. S. N.*

CHARLES K. HOLLOWAY, *Lieutenant Commander, MC, U. S. N.*

DIVERTICULUM of the duodenum is not an uncommon accidental finding in x-ray clinics during barium meal studies. It is agreed by most surgeons that such a diverticulum, if small and asymptomatic, is not of surgical significance; but if it is large or if signs and symptoms are related to it, surgical removal is the treatment of choice. Complete cure with relief of symptoms may be anticipated.

Incidence. Early observers considered duodenal diverticulum to be rare. Maissa (2) in Argentina reported only 1 case in a series of 19,000 roentgenographic examinations and 1 case in another series of 3,400 such examinations. Beals (3) reported an incidence of 2.2 percent in 1,887 consecutive examinations. Of the 41 diverticulums found, only 1 patient was operated on. Warren and Emery (4) reported 2.3 percent at Peter Bent Brigham Hospital. Dunstan et al. (5) cited an incidence of 2.2 percent. Ackermann (6) developed a technic for demonstrating duodenal diverticulum with plaster of paris injection of the bowel in the cadaver and found 11 diverticulums in 50 subjects. Duodenal diverticulum is most common in patients over 45 years of age. Beals (3) found the average age of 34 patients with such a diverticulum to be 53.3 years, though he did find one in a girl of 16 years. Finney (7) stated that patients between the ages of 60 and 70 years furnish the greatest number of cases. The sex incidence has been found by most authors to be about equal.

Etiology and pathology. Although the exact explanation for the development of a duodenal diverticulum is not known, traction, pulsion,

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(1) U. S. Naval Hospital, Oakland, Calif.

(2) Maissa, P. A.: Diverticulos gastro-duodenales; consideraciones clinico-radiológicas. Prensa med. argent. 30: 2014-2024, Oct. 20, 1943; also, An. Dispen. pub. nac. para enferm. d. ap. digest. 6: 615-643, 1943.

(3) Beals, J. A.: Duodenal diverticula. South. M. J. 30: 218-222, Feb. 1937.

(4) Warren, H. A., and Emery, E. S., Jr.: Duodenal diverticula, with special reference to their symptomatology. Gastroenterology 1: 1085-1092, Dec. 1943.

(5) Dunstan, E. M.; Lowance, M. I.; and Jones, E. C.: Clinical importance of duodenal diverticula. South. M. J. 42: 460-467, June 1949.

(6) Ackermann, W.: Diverticula and variations of duodenum. Ann. Surg. 117: 403-413, Mar. 1943.

(7) Finney, J. M. T., Jr.: Duodenal diverticula; their significance and treatment. South. Surgeon 11: 543-554, Aug. 1942.

and congenital weak spots have been suggested. Edwards (8) has written of the congenital weak spots that occur along the mesenteric border of the bowel at the points where blood vessels and lymph channels transit. The frequent occurrence of diverticulums at the second portion of the duodenum suggests that there is a weakness of the bowel wall about the sites of the passage of the common bile duct and the pancreatic duct. MacLean (9, 10) suggested that the heterotrophic pancreatic tissue present in the duodenal wall might serve to weaken the bowel. Increased intraluminal pressure may play an important role in the production of such defects. This, according to Finney (7), conforms to the dynamics involved in the production of pulsion diverticulum of the esophagus as well as the forces involved in development of hernias in general. Bockus (11) believed that there is a loss of the normal perivascular stroma together with a possible deficit of intrinsic muscular tone associated with advancing years.

Great disparity exists with reference to the terminology describing the various duodenal diverticulums. Blackwell (12) classified them as follows: a *true diverticulum* is considered one in which the wall is composed of all the normal layers of the duodenum; a *false diverticulum*, one in which the muscular coats are lacking and there is herniation of the mucosa through the defect in the muscularis. In addition, the terms "pseudo" and "genuine" are often used. Pseudo indicates a relative outpouching due to an associated scarring, such as from a duodenal ulcer; genuine signifies a diverticulum of a true or false nature. The designations "congenital" and "acquired," and "primary" and "secondary" are also used. Various theories have been advocated supporting the congenital nature of diverticulums, although it must be conceded that discovery of duodenal diverticulums in infants' and children by x-ray examination or at autopsy is extremely rare. Bockus (11) emphasized that there is no way to determine exactly whether a diverticulum is congenital or acquired. This is of relatively little importance. The important thing is to recognize that a diverticulum may cause symptoms.

Wheeler (13) observed that even a large diverticulum may not produce symptoms for a long time. The usual way in which these diverticulums give trouble is the development of inflammation in their

(8) Edwards, H. C.: Diverticula and Diverticulitis of the Intestine: Their Pathology, Diagnosis, and Treatment. Williams & Wilkins Co., Baltimore, Md., 1939. pp. 36-113.
(9) MacLean, N. J.: Diverticulum of duodenum, with report of case in which the diverticulum was imbedded in head of pancreas, and a method for its removal. Surg., Gynec. & Obst. 37: 6-13, July 1923.
(10) MacLean, N. J.: Duodenal diverticulitis. Ann. Surg. 85: 73-83, Jan. 1927.
(11) Bockus, H. L.: Gastro-enterology; Vol. II, The Small and Large Intestine and Peritoneum. W. B. Saunders Co., Philadelphia, Pa., 1947. pp. 107-119.
(12) Blackwell, C. C.: Duodenal diverticula. Am. J. Surg. 80: 946-953, Dec. 1950.
(13) Wheeler, D.: Diverticulum of duodenum. Canad. M. A. J. 39: 214-219, Sept. 1938.

walls. Diverticulosis becomes diverticulitis. Once this has occurred, necrosis and perforation may occur. Cholangitis and acute and chronic pancreatitis are often associated.

These diverticulums may measure from 0.5 to 10 cm. in diameter. Multiple diverticulums have been found in about 7 percent of the cases.

Location. Most duodenal diverticulums project from the concave aspect of the duodenum in the second, third, and fourth portions. Warren and Emery *(4)* found 65 percent of these in the second portion, 15.5 percent in the third, and only 8.7 percent in the first portion. Bockus *(11)* stated that about 75 percent of the pouches are located in the second part of the duodenum, a great number occurring adjacent to the ampulla of Vater. A genuine diverticulum occurs rarely in the first portion of the duodenum, although Blackwell *(12)* recently reported a patient with such a condition who was cured by operation.

Diagnosis and symptoms. There is no true symptom complex that is pathognomonic of duodenal diverticulum, though certain symptoms and complaints may suggest the condition. The diagnosis can only be made by careful roentgenologic study. Various special technics have been developed to assist in the visualization of diverticulums which otherwise would be missed. Changes in position during fluoroscopy; the use of compression devices; 4-, 6-, and 24-hour retention studies; and a high index suspicion result in the highest percent of accurate diagnoses.

Symptoms may vary from a few vague, indefinite complaints by the patient to those of a disabling nature. As a rule they simulate either those of peptic ulcer or gallbladder disease. From about 10 to 50 percent of the patients with a known diverticulum have symptoms. Typically, pain occurs at varying intervals after meals and is usually located above and to the right of the umbilicus. At times there is nausea and occasionally vomiting. A feeling of heaviness in the epigastrium is often a constant symptom. A change of position will sometimes relieve the patient of his discomfort. Diarrhea occurs once in a while as a result of putrefaction of the contents of the pouch. Inflammation causes tenderness over the right upper abdominal quadrant, but may also be present without causing symptoms. Even after a definite diagnosis has been made, it does not necessarily follow that the diverticulum is the cause of the symptoms *(12)*. It is essential, therefore, that other conditions be ruled out before the treatment of the diverticulum is considered.

Treatment. For a diverticulum which produces mild, nondebilitating symptoms, a medical regimen is advocated. This includes an ulcer-type diet with postural drainage and a mild laxative, if necessary. Guthrie and Brown *(14)* recommended gentle massage over the area,

(14) Guthrie, D., and Brown, M. J.: Diverticula of proximal intestine: duodenum and jejunum. Am. J. Surg. 40: 128-139, Apr. 1938.

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rest, proper diet, and avoidance of large meals. Surgical intervention is generally recommended for a diverticulum which produces symptoms indicative of moderate to severe inflammation. Early operation in such a situation will prevent perforation, peritonitis, and hemorrhage.

Operative technic. Ferguson and Cameron *(15)* recommended inversion of the pouch and simple closure of the muscular ring. In a patient with a small diverticulum of limited accessibility this is a satisfactory solution. Mahorner and Kisner *(16)* advised the complete removal of the pouch if possible. Often the common bile duct and pancreatic duct may be so situated as to make complete extirpation unfeasible, in which case simple inversion, provided it does not produce the possibility of obstruction, is the treatment of choice. Positive identification of the sac may be difficult if the diverticulum is small and buried between the leaves of the mesentery. Mahorner and Kisner *(16)* have devised a method of insufflation of the duodenum with air from an indwelling duodenal tube. This is said to facilitate identification of the pouch. Pearse *(17)* has advised a technic in which he mobilizes the duodenum to the left and dissects out the diverticulum to the right. MacLean on occasions has used a transduodenal approach with success when the diverticulum could not otherwise be identified and mobilized. A catheter may be inserted into the common bile duct from above for identification in such cases. The third and fourth portions of the duodenum have been approached by MacLean *(10)* from below by mobilizing the transverse colon and its mesentery, taking care not to disturb the middle colic artery.

CASE REPORT

A 57-year-old man was admitted to this hospital on 5 April 1950 complaining of painful fullness of the epigastrium, unpleasant gaseous eructations, and occasional nausea but no vomiting after meals. He described the pain as gradual in onset and becoming severe in the area to the right of the epigastrium. The pain radiated through to his back on the right side. His gastrointestinal symptoms dated back 10 years when he was hospitalized for a severe, prolonged illness with similar signs and symptoms. He stated that his abdomen was quite sore and tender for several weeks and that he had a severe episode of constipation unrelieved by enemas. He was confined for 5 months with this illness which his doctor described as a "nervous breakdown." There was no history of melena, hematemesis, or extreme weight loss. Gastrointestinal upsets of a milder nature were present until the present episode, which seemed to have been brought on by a rather

(15) Ferguson, L. K., and Cameron, C. S., Jr.: Diverticula of stomach and duodenum; treatment by invagination and suture. Surg., Gynec. & Obst. 84: 292-300, Mar. 1947.

(16) Mahorner, H., and Kisner, W.: Diverticula of duodenum and jejunum, with report of new technical procedure to facilitate their removal and discussion of their surgical significance. Surg., Gynec. & Obst. 85: 607-622, Nov. 1947.

(17) Pearse, H. E.: Surgical management of duodenal diverticula. Surgery 15: 705-712, May 1944.

Figure 1. Roentgenogram taken with the patient standing. A gas-filled diverticulum with a residuum of barium is to be seen in the right upper abdominal quadrant. Figure 2. Roentgenogram taken with patient lying down. The barium has gravitated to a dependent position.

severe jolt from a fall. Previous roentgenograms and interpretations were not available, but were described by the patient as having shown "crossed intestines and a perforation."

Except for mild tenderness over the epigastrium and to the right, the physical examination was within normal limits. Barium meal studies demonstrated a tremendous diverticulum of the second portion of the duodenum (figs. 1 and 2). Various fluid levels were seen throughout the examination and the patient was extremely tender over the diverticulum. At the end of 24 hours, a large residue of fluid and barium remained in the diverticulum.

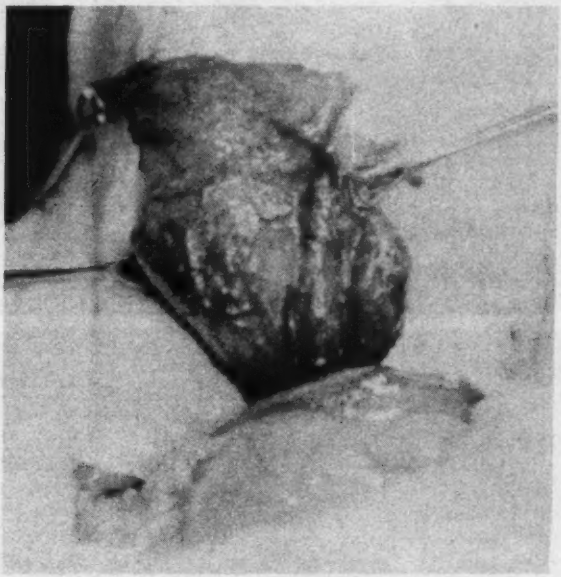

Figure 3. The diverticulum at the time of its delivery.

On 18 April, under spinal anesthesia supplemented with pentothal sodium intravenously, a right upper paramedian incision was made through a thin abdominal wall. The right rectus muscle was reflected laterally, the peritoneum was opened, and a thin-walled, slightly elongated, gas- and fluid-filled sac measuring 10 by 12 by 6 cm. which was lateral and slightly posterior to the second portion of the duodenum was found. Reflection of the mesenteric serosal layers over the sac was easily accomplished to reveal the attachment of the diverticulum along the mesenteric border of the middle third of the second part of the duodenum, distal to the ampulla of Vater. This attachment was by a neck 3 cm. in diameter (fig. 3). Gentle manipulation caused the diverticulum to deflate almost completely and allowed the neck

to be tied off with a silk suture. The neck was then divided from the duodenum and the stump inverted transversely with No. 000 silk sutures. Further exploration failed to reveal additional diverticulums. The large space occupied by the diverticulum was obliterated by closing with interrupted No. 000 silk sutures the peritoneal reflection which had been opened. The abdomen was closed in layers, using a running No. 00 chromic gut suture for the peritoneum and interrupted No. 000 silk for the fascial layers.

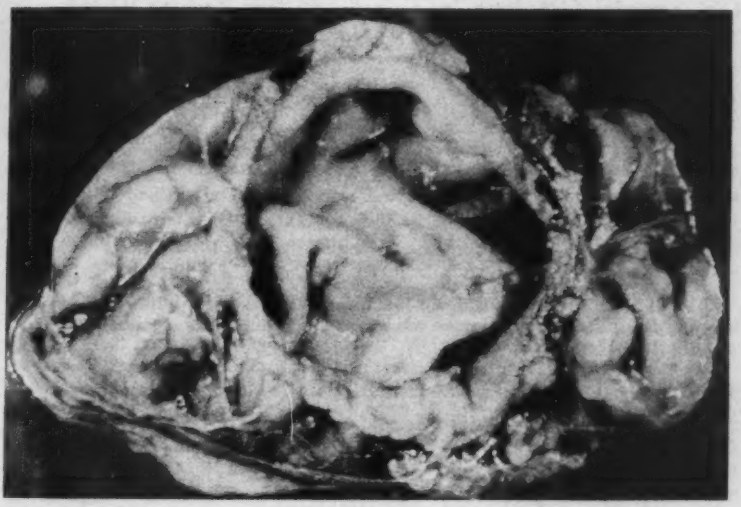

Figure 4. Surgical specimen of diverticulum.

The patient's postoperative course was uneventful and he was discharged from the hospital on the eighth postoperative day completely free of pain for the first time in many years.

The pathologist reported a diverticulum which, before being fixed in formalin, measured 10 cm. in diameter by 12 cm. deep with a 6-cm. lumen at the neck. One area, 4 cm. in diameter, was blue. Microscopic study of the sections disclosed the only muscle fibers present to be those of the muscularis mucosae, making this a "genuine" false diverticulum. The mucosal lining consisted of crypts lined by a single layer of tall columnar cells, a few of which were mucus-secreting. There were no underlying Brunner's glands (fig. 4).

Comment. This patient had the largest duodenal diverticulum that has yet been recorded. It illustrates the excellent results that may be expected from the surgical treatment of a duodenal diverticulum once the diagnosis has been made and other conditions which might have caused the patient's complaints have been ruled out. Because no symptom complex leads directly to the diagnosis of duodenal diver-

ticulum, it is well to keep the diagnosis in mind as a possibility when studying patients with upper gastrointestinal and biliary complaints. In several instances a duodenal diverticulum, together with cholecystitis and cholelithiasis, has been found although the exact diagnosis has not been made until the operation was performed. Slater and Parsons *(18)* described such a case. When a biliary operation does not relieve the patient, subsequent examination may reveal a duodenal diverticulum. This situation has been described by Blackwell *(12)*, Lucinian *(19)*, Hare and Cattell *(20)*, and Rankin *(21)* and it is not unusual for gallstones to be present in the diverticulum.

The value of a barium meal study should be stressed as the principal diagnostic procedure. A careful history and physical examination can lead the surgeon to suspect the diagnosis. Surgical treatment should be instituted whenever a duodenal diverticulum is known to be present and giving troublesome symptoms.

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(18) Slater, F. M. B., and Parsons, W. H.: Surgical aspects of diverticula of duodenum with report of additional surgical case. South. Surgeon 14: 240-247, Apr. 1948.

(19) Lucinian, J. H.: Diverticulum of duodenum perforated into pancreas; report of case. Am. J. Roentgenol. 24: 684-685, Dec. 1930.

(20) Hare, H. F., and Cattell, R. B.: Symposium on gastro-intestinal surgery; duodenal diverticulum simulating gallbladder colic; report of case. S. Clin. North America 24: 635-639, June 1944.

(21) Rankin, L. M.: Diverticula of duodenum. Am. J. Roentgenol. 47: 584-587, Apr. 1942.

SUBSTITUTE BLADDER OPERATION ON A PARAPLEGIC[1]

IRWIN T. RIEGER, *Lieutenant, MC, U. S. N. R.*

JOHN R. WEISSER, *Captain, MC, U. S. N.*

RECENTLY Gilchrist et al. *(2, 3)* demonstrated both experimentally and on human beings that a continent substitute bladder and urethra could be created from the isolated terminal ileum and ascending colon (figs. 1, 2, and 3). The advantages of urinary diversion by this method are: (1) no collecting device is necessary, (2) there is no soiling such as occurs with a wet colostomy, (3) the ureters are not contaminated by the fecal stream, (4) cystoscopy of the substitute bladder is possible, and (5) there is no limitation of radical operations when dealing with pelvic malignancies.

Bricker and Eiseman *(4)* have also reported the performance of this operation on several patients. At the time of this writing no other reports of this operation have appeared in the literature. Interest in this procedure has, however, been awakened and it is being performed in various parts of the country. In a procedure as radical as this the patients must be carefully selected.

In the case here reported a substitute bladder was created according to the method of Gilchrist et al. *(2)*, in a paraplegic. To our knowledge this operation has never before been performed on a complete paraplegic.

CASE REPORT

A 26-year-old Negro soldier was admitted to the orthopedic service of this hospital on 12 September 1951 with the diagnosis of a compression fracture of the eighth thoracic vertebra with spinal cord involvement. He had been transferred from a civilian hospital. The

(1) U. S. Naval Hospital, Great Lakes, Ill.

(2) Gilchrist, R. K.; Merricks, J. W.; Hamlin, H. H.; and Rieger, I. T.: Construction of substitute bladder and urethra. Surg., Gynec. & Obst. 90: 752-760, June 1950.

(3) Merricks, J. W.; Gilchrist, R. K.; Hamlin, H. H.; and Rieger, I. T.: A substitute bladder and urethra, using cecum as bladder and ileum as urethra. J. Urol. 65: 581, 1951.

(4) Bricker, E. M., and Eiseman, B.: Bladder reconstruction from cecum and ascending colon following resection of pelvic viscera. Ann. Surg. 132: 77-84, July 1950.

past history indicated that on 30 August he had fallen to the ground from a second story porch. Immediately following the fall he noticed that he was completely paralyzed from the waist down. On admission to the civilian hospital a spinal manometric study showed a complete block of the spinal canal with a sensory level found at about the ninth thoracic segment. On 31 August a decompression was performed by removing the lamina completely from the fifth, sixth, seventh, and eighth thoracic vertebras. The dura was found to be lacerated in both lateral recesses and the spinal cord appeared to be completely severed at the level of the seventh thoracic vertebra. An uneventful recovery was made from this operation.

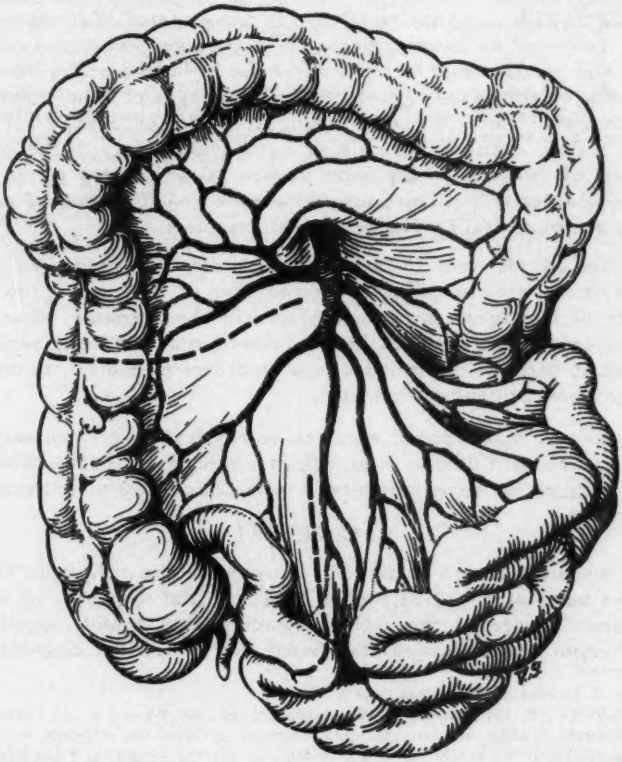

Figure 1. Demonstration of lines of section of bowel and mesentery in formation of substitute bladder and urethra. In practice the colon should be sectioned at or near the hepatic flexure. (Reprinted by courtesy of Surgery, Gynecology and Obstetrics. See footnote reference (2).)

On admission to this hospital the patient had complete motor and sensory loss at a level of the eighth thoracic vertebra. Treatment was directed toward care of the neurogenic bladder, prevention of decubitus ulcers, and prevention of contracture of the lower extremities. He was treated daily with passive exercises and whirlpool baths. The bladder

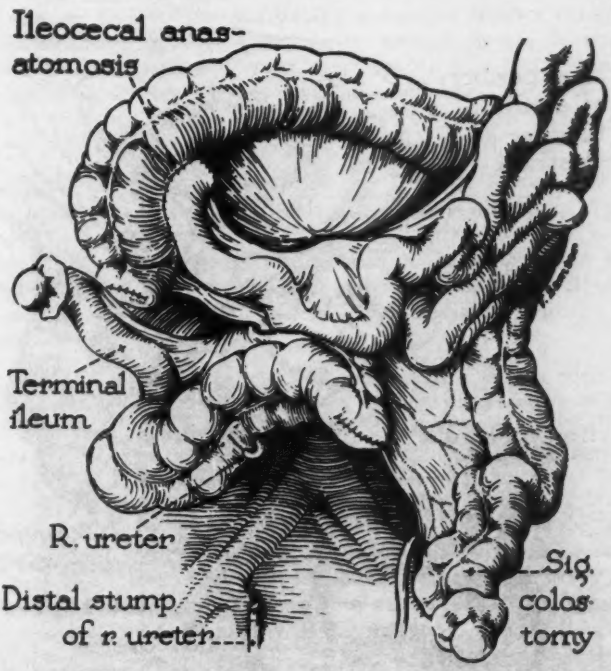

Figure 2. Ileocolostomy is performed to re-establish bowel continuity. The substitute bladder is swung downward to the left to lie transversely at the pelvic brim and the ureters are transplanted to it. The formation of a colostomy which might be necessary in the resection of an extensive pelvic malignancy is also shown. (Reprinted by courtesy of Surgery, Gynecology and Obstetrics. See footnote reference (2).)

was irrigated hourly through an indwelling Foley urethral catheter with dilute potassium permanganate solution. Antibiotics were given to prevent secondary infections. In spite of these measures the patient developed severe chills and fever, the temperature rising to about 103° F. daily for 2 weeks. Aureomycin, chloramphenicol, penicillin, and gantrisin were all tried with no success. It was thought that this was a urethral reaction due to the indwelling catheter.

As the patient's general condition had begun to deteriorate, it was decided to perform a suprapubic cystostomy. This was done on 13 October. At operation the bladder was found to be a solid, fixed, grapefruit-sized mass with a wall 4 or 5 cm. thick. The wall resembled scar tissue, cut with the resistance of scar tissue, and could not be stretched. A biopsy specimen was taken through the whole thickness

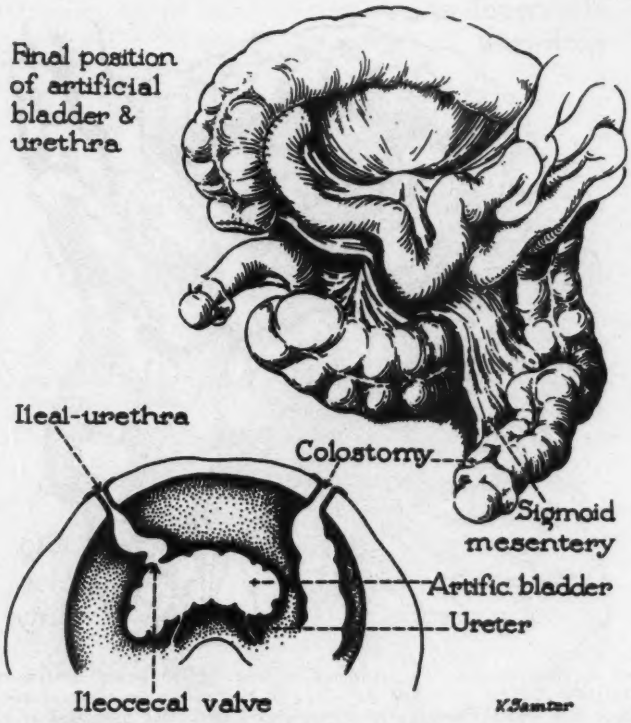

Figure 3. Demonstration of end result again showing a colostomy if it is necessary to perform one. (Reprinted by courtesy of Surgery, Gynecology and Obstetrics. See footnote reference (2).)

of the bladder wall. The interior of the bladder had a fixed total capacity of less than 30 cc. A Foley catheter was placed in the bladder, a Penrose drain was placed in the prevesical space, and the wound was then closed around the catheter and drain. The patient left the operating room in good condition and was transferred to the urology service. No anesthesia had been necessary.

Chloramphenicol, blood transfusions, daily physiotherapy, hourly turning of the patient, and the well-functioning suprapubic tube all

contributed to a rapid improvement. The patient became afebrile and began to eat well and gain weight.

At the time of the suprapubic cystostomy it was suspected that the bladder tissue had become completely and irreversibly replaced by fibrous tissue apparently due to a previously unsuspected severe phlegmonous cystitis. The biopsy report confirmed this and stated that no muscle tissue remained in the bladder wall. It was then realized that there was no hope of re-establishing automatic bladder control and that the bladder capacity would never exceed 60 cc. It would be necessary for the patient to wear a suprapubic tube and a collecting apparatus with all its hazards and inconveniences the remainder of his life.

Because of the extremely small interior of the bladder which fit too snugly about the suprapubic catheter (both de Pezzer and Foley catheters were tried), it was difficult to maintain satisfactory drainage. Leakage from the urethra and about the suprapubic tube occurred frequently, wetting the patient and the bed. If the patient were ever to be rehabilitated to the point of being able to care for himself and fit into society, a more satisfactory method of urinary drainage would have to be found.

Accordingly, after fully explaining the situation to the patient and with his permission, it was decided to attempt the creation of a continent substitute bladder which would do away with all collecting apparatus, only requiring catheterization by the patient himself every few hours to prevent overflow leakage.

Preoperative study revealed the upper urinary tract to be normal as shown by intravenous pyelograms. Cystoscopy yielded no new information. The blood findings, including nonprotein nitrogen, proteins, and hemoglobin, were normal. After careful bowel preparation the patient was again taken to surgery on 3 December.

Under intratracheal cyclopropane, oxygen, and nitrous oxide anesthesia, the abdomen was entered through a long right paramedian incision. The terminal ileum and ascending colon were freed and retracted medially. The appendix was removed. The terminal ileum was divided 9 inches proximal to the ileocecal valve and the colon was divided just distal to the hepatic flexure. An end-to-end ileocolostomy to reestablish bowel continuity was performed leaving the terminal ileum and ascending colon isolated. The open end of the isolated colon was closed and the completed colonic pouch rotated downward and medially so that it lay transversely at the pelvic brim with the ileocecal valve ventral in position. The ureters were then picked up through individual incisions in the posterior peritoneum, divided, and the distal ends ligated. The proximal ends of both ureters were transplanted to the colonic pouch, or substitute bladder, by a combination of the Cordonnier and Coffey I technics. The substitute bladder was anchored firmly

and the sites of ureteral transplantation were peritonealized. After bringing the terminal ileum (substitute urethra) out through a stab wound in the right epigastrium, the wound was closed without drainage. A Foley catheter was left in the substitute bladder. The patient left the operating room in good condition *(5)*.

Following operation the patient did remarkably well. A Levine tube was necessary for a few days. Urinary output was low for 2 days, presumably due to edema about the ureteral transplants, but after that varied from 1,200 to 2,000 cc. of clear urine daily. On the eighth postoperative day while receiving a bath the patient suddenly complained of severe chest pain, collapsed, and died. Blood drawn from the heart immediately postmortem revealed a nonprotein nitrogen of 27.5 mg. per 100 cc., a carbon dioxide combining power of 56.5 vol. per 100 cc. and chlorides of 549 mg. per 100 cc.

Permission for autopsy was obtained and the cause of death was found to be a massive pulmonary embolism due to thrombosis of the left femoral vein. The substitute bladder and bowel and ureteral anastomoses were in excellent condition both grossly and microscopically. There was no evidence of leakage or infection anywhere.

DISCUSSION

This death could, and possibly should, have been prevented. Ligation of the vena cava at the time of the substitute bladder operation would have prevented the fatal embolism. This procedure would have taken very little extra time and, in view of the paraplegia, would have caused the patient no inconvenience. In this instance it would have been lifesaving. We strongly suggest that ligation of the vena cava should be considered in any extensive abdominal operation in a hopeless paraplegic because of the difficulty in early detection of venous thrombosis. Carefully controlled anticoagulant therapy probably could be substituted for vena cava ligation.

We do not wish to give the impression that we advocate this operation for all paraplegics with neurogenic bladders. We realize that with proper treatment few patients with neurogenic bladders should have to be considered for this radical operation, but, in spite of excellent care, some neurogenic bladders cannot be made to function well and residual urine plus infection necessitates permanent urethral or suprapubic drainage. A tube is constantly present and must be cared for. Some collecting apparatus is required. These become very annoying to the patient. The presence of the tube causes a chronic cystitis and predisposes to stone formation. Acute and chronic infection of the kidneys occurs with the ultimate development of a progressive chronic pyelonephritis.

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(5) The intestinal operation was performed by Captain Weisser and the ureters were transplanted by Lieutenant Rieger.

If a substitute bladder is created, as described, for such a patient, a permanent drainage tube and collecting apparatus should not be required. The patient would learn to catheterize his new urethra at intervals of from 3 to 8 hours—often enough to prevent overflow leakage. As the mucosa of the bowel is bacteria resistant, strict aseptic technic need not be followed. Simple cleanliness should suffice. A small piece of gauze might be required to absorb the mucus secreted by the end of the ileal loop.

Continence of urine depends on several factors: the size of the new bladder, competency of the ileocecal valve, the peristalsis of the ileal urethra directed towards the substitute bladder, bringing out of the ileal urethra on the abdomen well superior to the substitute bladder, and finally the tightness of the abdominal wall about the "urethral" opening. In nonparaplegics complete continence can be obtained. Indeed, one of us (ITR) had a dog, used in the experimental development of this operation, that would have died in acute retention unless relieved by catheterization. Only when a number of paraplegics have been subjected to this procedure will the question of urinary continence in this group be definitely answered. As the vagus nerves innervate the small bowel and the ascending colon, it would seem that no difficulty in obtaining continence due to the paraplegia should arise.

It has been established both experimentally and clinically that changes in blood chemistry are not different from those of patients with ordinary ureterosigmoidostomies. Possibly most important to prolonging the lives of these patients, the ureters would not be emptying into a bladder chronically infected by a permanent catheter. This should greatly diminish the incidence of chronic pyelonephritis and other complications due to the chronic cystitis.

This procedure must be performed many more times before it can be evaluated properly. We suggest that this substitute bladder operation be considered in the armamentarium used in rehabilitating paraplegics.

BOOK REVIEWS

Simplified Arithmetic for Nurses, by *M. Esther McClain*, R. N., M. S., Instructor in Nursing Arts, Providence Hospital School of Nursing, Detroit, Mich. 151 pages. W. B. Saunders Co., Philadelphia, Pa., publisher, 1952.

This excellent handbook for nurses—students and graduates—contains 18 lessons, each of which has problems and assignments in other chapters of the text with answers supplied for the benefit of the teacher or the independent student. All pertinent arithmetical problems, such as (1) the use of the apothecaries' and metric

systems; (2) the use of household measures and equivalents in all systems; (3) the use of other weights and measures; (4) finding percentage strengths and ratios; (5) finding the amount of a pure drug; (6) finding the amounts necessary to mix solutions of various strengths; (7) finding the amount of insulin solution to use for a specified number of units; (8) finding the dose for a child over 1 year of age; (9) finding the dose for a child under 1 year of age; and (10) calculation of doses in minims that are not in exact multiples of 5, are covered. The illustrations of equivalents of apothecaries' and metric measures to household measures are excellent. After studying them carefully, no student should have difficulty in associating equivalents. The author has stated that "the arithmetic needed for preparing doses of drugs and solutions made from drugs is not difficult," and it is indeed simplified in this useful text.

—*Lt. Comdr. G. E. Dvorak, NC, U. S. N.*

The Treatment of Diabetes Mellitus, by *Elliott P. Joslin*, A. M., M. D., Sc. D., Medical Director, George F. Baker Clinic, New England Deaconess Hospital; Clinical Professor of Medicine Emeritus, Harvard Medical School; Consulting Physician, Boston City Hospital; *Howard F. Root*, M. D., Physician, New England Deaconess Hospital; Consultant in Medicine, Eastern Maine General Hospital, Massachusetts State Infirmary, Middlesex County Sanatorium, Sturdy Memorial Hospital; Associate in Medicine, Harvard Medical School; *Priscilla White*, M. D., Sc. D., Physician, New England Deaconess Hospital Instructor in Pediatrics, Tufts College Medical School; and *Alexander Marble*, A. M., M. D., Physician, New England Deaconess Hospital; Clinical Associate in Medicine, Harvard Medical School; Consultant in Internal Medicine, Veterans Administration. 9th edition. 771 pages; illustrated. Lea & Febiger, Philadelphia, Pa., publisher, 1952. Price $12.

This book hardly needs description because it has been one of the leading works on the subject for many years. It has been the authors' object to present a comprehensive treatise dealing with all aspects of diabetes. This reference book contains an extensive bibliography. Two long chapters are devoted to a general discussion of the incidence and cause of diabetes. Much important information is contained therein, but it is dull reading. There have been no sweeping changes in this latest revision. All of the chapters have been rewritten and a few new subjects, such as the use of neutral protamine Hagedorn (NPH) insulin, are discussed. The keystone of Dr. Joslin's philosophy regarding the treatment of diabetes is reiterated throughout the book; namely, that the more carefully the disease is controlled, the less likely are complications to occur and pathologic sequelas to develop. His tremendous experience with the disease over many years lends authority to this thesis.—*Commander H. E. Reitz, MC, U. S. N.*

GIANT BLADDER CALCULUS

DON S. WENGER, *Colonel, U. S. A. F. (MC)* (1)

CARL D. BERRY, Jr., *Captain, U. S. A. F. (MC)* (1)

BLADDER calculi of sufficient size to be classed as "giant" are reported from time to time. The large dimensions and weight of some of these calculi and their silent growth until the stone has reached huge proportions are of interest. The possibility of a bladder stone reaching giant size and remaining asymptomatic is unlikely because of the high incidence of associated diseases accompanying cystolithiasis. These diseases occur with some form of vesical neck obstruction in about 80 percent of vesical lithiasis and induce the patient to seek medical aid in most cases long before the stone reaches a large size. Damage to the upper urinary tract is nearly always present, usually in the form of hydronephrosis and urinary infection. Maslow and Garnello (2) reported a case of giant bladder calculus associated with upper urinary tract lithiasis and emphasized the rarity of such a combination. Chronic irritation, possibly a predisposing factor in carcinoma of the bladder, is present over a prolonged period in cases of giant bladder stone. In spite of this, the incidence of carcinoma of the bladder associated with giant bladder calculi appears to be no higher than with cystolithiasis in general.

The urologist treating a patient with a giant vesical stone is not only confronted with a varying degree of infection and damage to both the lower and upper urinary tracts but also with the technical difficulties of removing a large, fixed calculus with as little trauma as possible to the bladder and adjacent structures. In spite of these obstacles, even the largest stone can be removed successfully. Lepreau and Jenkins (3) reported the removal of a 2½-pound bladder calculus with recovery of the patient.

Giant bladder stone is less common in women than in men. In this article we report a female patient with a giant bladder calculus complicated by perivesical lipomas, partial erosion of a portion of the

(1) U. S. Air Force Hospital, Chanute Air Force Base, Ill.

(2) Maslow, L. A., and Garnello, J.: Giant bladder calculus associated with upper urinary tract lithiasis; case report. J. Urol. 58: 441-443, Dec. 1947.

(3) Lepreau, F. J., Jr., and Jenkins, R. H.: Instrumental removal of 2½-pound bladder calculus, with recovery. New England J. Med. 229: 937-938, Dec. 16, 1943.

bladder, and bilateral hydronephrosis. We have found no other report of such a case associated with perivesical lipomas.

CASE REPORT

A 45-year-old Negress entered this hospital on 6 April 1951 complaining of severe suprapubic pain and urinary incontinence of 6 months' duration. These symptoms were relatively mild and inconstant at first but became progressively more severe. She had lost 30 pounds in the preceding 8 months.

Figure 1. Intravenous urogram showing huge bladder calculus and associated upper urinary tract pathology.

On admission tenderness was elicited over the renal areas. The kidneys were about twice their normal size. A hard mass was felt in the suprapubic region. This region was exquisitely tender. The mass was more readily palpable vaginally and was hard, immobile, and the size of a small grapefruit. It impinged on and completely obstructed

the vaginal vault near the introitus. There was constant leakage of urine from the urethra.

The urine was cloudy, foul, and alkaline with a specific gravity of 1.016. It contained 2 plus albumin. Many leukocytes, erythrocytes, epithelial cells, mucous threads, and triple phosphate crystals were seen on microscopic examination. Culture of the urine showed *Escherichia coli* and *proteus vulgaris*. The cardiolipin test was 3 plus with a Kahn titer of 10 units. The nonprotein nitrogen was 54 mg. per 100 cc.; urea nitrogen, 28.6 mg. per 100 cc.; creatinine, 2.17 mg. per 100 cc.; blood calcium, 22 mg. per 100 cc.

A roentgenogram of the abdomen revealed a large laminated calculus in the bladder region. In addition to the calculus an intravenous urogram showed a large hydronephrosis of the left kidney with dilation of the ureter but no delay in dye excretion (fig. 1). There was no excretion of contrast medium from the right kidney in 2 hours.

A diagnosis of giant vesical calculus with bilateral hydronephrosis and latent secondary syphilis was made. In spite of the elevated blood calcium there was no evidence of hyperparathyroidism.

Treatment of the syphilitic infection with penicillin was begun immediately and on 11 April, under ether anesthesia, the bladder region was exposed through a lower abdominal transverse incision. The bladder was found to be fixed and partially obscured by firm, irregular, lobulated masses which appeared grossly to be lipomas. This was verified by frozen section. The lipomas were dissected free and removed. The calculus was firmly wedged and filled the entire bladder cavity. The anterior bladder wall was almost completely eroded. In spite of every precaution, avulsion of this portion of the bladder with a tear into the floor and adjacent posterior urethra occurred during delivery of the stone. The floor of the bladder and urethra were repaired around a 16 Fr. straight urethral catheter that was inserted through the external urethra and left in place. The remaining devitalized tissue of the anterior bladder wall was excised and the bladder was repaired around a mushroom catheter which was brought out suprapubically. The incision was closed in layers with Penrose drains inserted in the space of Retzius and the lateral paravesical spaces.

Penicillin and streptomycin were administered postoperatively. Five hundred cc. of blood was given on the second postoperative day because of a low hemogram. Careful attention was directed to the patient's vitamin and protein intake. Sutures and drains had been removed by the eleventh postoperative day. The incision healed promptly around the suprapubic tube. Adequate urinary output was maintained. The indwelling urethral catheter was removed about 3½ weeks following the operation and the suprapubic tube was removed a short time later when the patient gave sufficient evidence of a continent bladder and ability to void. A cystogram revealed a small bladder with an essentially normal contour.

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Because the patient was returning to a rural community without adequate medical service, she was kept in the hospital until 27 June. At that time she was active and symptom-free except for occasional urgency, stress incontinence, and nocturia 2 or 3 times a night. Blood chemistry determinations remained at the preoperative levels. The urine showed a persistence of from 15 to 20 pus cells per high power field but was otherwise normal.

Figure 2. Bladder stone after removal.

The calculus measured 7 by 6.5 by 6 cm. and weighed 154 grams (fig. 2). Cross section revealed it to be made up of gray-white and olive-drab crystals of uniform size. Four layers were present. There was no evidence of a foreign body nucleus. Chemical analysis showed the stone to be made up of calcium carbonate, calcium phosphate, and ammoniomagnesium phosphate.

SUMMARY

Urinary bladder calculi can reach gigantic size before causing symptoms leading to discovery. Giant stones are uncommon because the associated disease of the urinary tract present in a high percent of patients leads to early discovery and removal of the stones before they can attain a large size. Such calculi are particularly uncommon in women.

PAROXYSMAL COLD HEMOGLOBINURIA

BEN D. HALL, *Captain, MC, U. S. A. (1)*

PAROXYSMAL cold hemoglobinuria is a rare condition. Jones and Jones *(2)* reported that there were only 9 cases among 156,000 consecutive admissions to the Massachusetts General Hospital in Boston in 30 years; and at the Peter Bent Brigham Hospital in Boston, there were only 3 cases among 74,186 consecutive admissions. Howard et al. *(3)* found only 2 cases among 208,878 admissions over a 38-year period at the Montreal General Hospital. Becker *(4)* reported only 1 case among 130,000 hospital patients and 382,791 clinic patients over a 20-year period at the University of Chicago Clinics.

Because the disease is a manifestation of late congenital or acquired syphilis, it is confined to no particular age. In congenital syphilitics, it rarely appears before the fifth or sixth year. In patients with acquired syphilis, it occurs most frequently between the third and sixth decades. Men are about 3 times as prone to the disease as women, a ratio corresponding to the incidence of syphilis. It is peculiar to no race but is reported most frequently among people living in seasonally cold climates. An important factor influencing its occurrence is exposure to temperatures low enough to initiate paroxysms.

A survey of available records reveals no case of paroxysmal cold hemoglobinuria reported from the Territory of Hawaii, although since 1930 there have been 644 cases of congenital syphilis and many times that number of cases of late latent syphilis reported by the Territorial Board of Health. A Japanese-Hawaiian patient who, had he not been exposed to the severe chilling of a Korean winter, might have remained undiagnosed, is here reported.

(1) Tripler Army Hospital, Honolulu, T. H.

(2) Jones, B. B., and Jones, C. M.: Paroxysmal hemoglobinuria. In Nelson's Loose-Leaf Medicine. Thomas Nelson & Sons, New York, N. Y. Vol. 4, p. 173G.

(3) Howard, C. P.; Mills, F. S.; and Townsend, S. R.: Paroxysmal hemoglobinuria with report of case. Am. J. M. Sc. 196: 792-796, Dec. 1938.

(4) Becker, R. M.: Paroxysmal cold hemoglobinurias. Arch. Int. Med. 81: 630-648, May 1948.

CASE REPORT

A 22-year-old Japanese-Hawaiian, one of 8 siblings, was the offspring of a syphilitic mother. His childhood was uneventful except for the history of a "rash" during childhood whenever he was exposed to cold. There was one episode during childhood in which he was exposed to unusually cold Hawaiian weather and is said to have passed dark urine subsequently. In 1947, on the basis of a positive serologic test, a diagnosis of congenital syphilis was made. Physical examina-

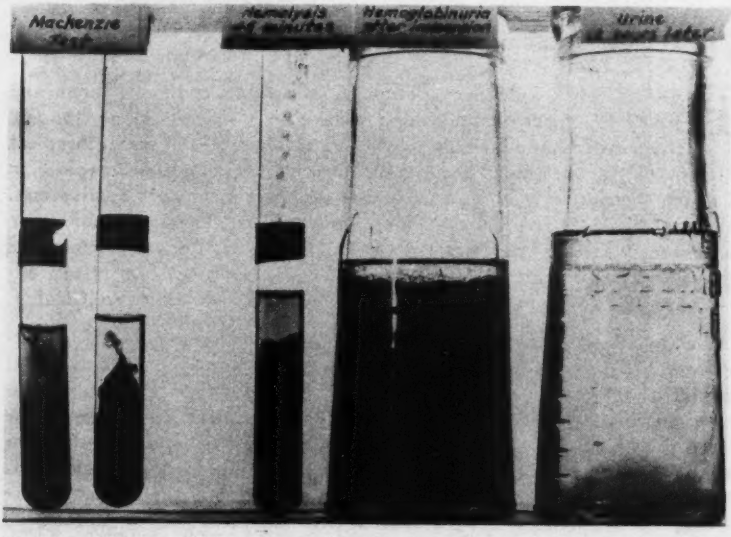

Figure 1. Photograph of in vivo and in vitro tests for the cold-warm hemolysin. The two tubes on the left demonstrate the Mackenzie test. The remaining tube and the bottles show results of the Rosenbach test.

tion and spinal fluid studies at that time were negative. In the interval between May 1947 and November 1949, the patient received a course of 20 injections of an arsenical, 20 injections of bismuth, and 6 million units of penicillin. Repeated serologic tests for syphilis were positive and he was considered to have serologic fastness. Spinal fluid studies in May 1951 were negative. He was inducted into the Army in June and received his basic training at the Hawaiian Infantry Training Center. He was sent to Korea and arrived there in December. On 9 January 1952, during severe winter weather, he noted that his urine turned dark red for several hours. This was accompanied by general malaise and muscular aching. He consulted his unit surgeon but was unable to demonstrate any dark-colored urine and was returned to duty. Five days later, while riding in an open truck on convoy, he became severely chilled. Shortly thereafter he again passed port-wine colored urine and noted muscular aching and malaise. He was admitted

to the 171st Evacuation Hospital where a diagnosis of paroxysmal cold hemoglobinuria was established and he was transferred to this hospital.

On admission he was completely asymptomatic. Physical examination revealed no evidences of congenital syphilis. The cardiolipin flocculation and cardiolipin complement-fixation tests were positive with a quantitative titer of 1:8. The thymol turbidity was 5.5. The icteric index was 12. The results of the Mackenzie and Rosenbach tests are shown in figure 1. Inasmuch as the precipitation of intravascular hemolysis and hemoglobinuria was not demonstrated by immersion of only one hand in ice water, it was considered safe to immerse both hands and both feet. This was done for a period of 20 minutes. Blood was drawn 45 minutes after rewarming and hemolysis of erythrocytes was demonstrated as shown on the right side of figure 1. The patient noted only mild malaise and muscular aching, and several hours later hemoglobinuria was noted. The urine was dark red in color, clear and translucent, positive for blood by chemical test, and negative for red blood cells on microscopic examination. The next urine sample passed 12 hours later was again light amber in color.

On an empirical basis the patient was given 600,000 units of procaine penicillin daily for 10 days. Fifteen days after completion of the treatment, the Mackenzie test was repeated and again found to be positive. Treatment with 2 courses of penicillin and a course of arsenical and heavy metal had not materially altered his disease.

DISCUSSION

Excellent reviews of this disease have been written *(4-6)*. According to Mackenzie *(5)*, Dressler in 1854 first published an account of a case of albuminuria and dark-red urine in which no red blood cells could be found. Shortly thereafter, Hassal identified the pigment as hemoglobin and associated the paroxysmal hemoglobinuria with chilling. Rosenbach *(7)* demonstrated that placing the hands and feet of the patient in ice water would precipitate a paroxysm, and this test today bears his name. Murri called attention to the association of this disease with syphilis. Donath and Landsteiner discovered the hemolysin present in the serum of these patients by in vitro tests. Salen showed that there were two types of paroxysmal cold hemoglobinuria, one occurring in syphilitic patients and associated with the cold-warm hemolysin previously identified by Donath and Landsteiner, and the other being seen in nonsyphilitic patients in whom no cold-warm hemolysin was present but in whom there was an un-

(5) Mackenzie, G. M.: Paroxysmal hemoglobinuria; review. Medicine 8: 159-191, May 1929.

(6) Ross, J. F.: Medical progress; hemoglobinemia and hemoglobinurias. New England J. Med. 233: 691, Dec. 6, 1945; 732, Dec. 13, 1945; 766, Dec. 20, 1945.

(7) Rosenbach: Cited in footnote reference *(4)*.

usually high titer of cold hemagglutinins. This article is concerned with only the syphilitic variety. The differentiation between the 2 varieties is shown in table 1.

TABLE 1. *Differentiation between 2 types of paroxysmal cold hemoglobinuria*

	Syphilitic	Nonsyphilitic
Hemolysin	Cold-warm	Cold or none
Hemolysin specificity	Type specific	None
Cold agglutinin	Absent	Present in high titer
Serologic test for syphilis	Positive (essential)	Negative or false positive
Complement	Required	Not required
Dermolysin	Present	Absent
Cold urticaria	Often present	Absent
Treatment	Antisyphilitic	None

Patients with syphilitic paroxysmal cold hemoglobinuria have circulating in their blood stream a hemolysin which, with complement, becomes fixed to the red blood cells when the patient is exposed to cold. When the patient subsequently becomes warm, and only after warming, the hemolysin-complement complex brings about hemolysis of the red blood cells. Hemoglobin is thus released and the red blood cell count and hemoglobin fall. When the hemoglobinemia exceeds the renal threshold for hemoglobin, hemoglobinuria occurs. Destruction of about one-sixtieth of the red blood cells in the body is believed to be necessary to exceed the renal threshold *(8)*. Spectroscopic examination of the urine reveals the color to be due to oxyhemoglobin, methemoglobin, and, sometimes, hematin *(9)*.

With the hemolytic episode the patient clinically experiences a shaking chill, fever, generalized abdominal cramps, drenching sweats, nausea, weakness, headaches, and muscular aching. The severity of the clinical manifestations depends on the degree of intravascular hemolysis. Each paroxysm lasts from 1 to 3 hours, after which the patient usually feels well. Repeated attacks will leave the patient anemic and weak. The urine may remain red or dark for from 4 to 10 hours.

The responsible hemolysin is properly termed a "cold-warm hemolysin" and can be demonstrated in one of several ways. The Donath-

(8) Dickson, J. G.: Paroxysmal hemoglobinuria, with report of case followed for 13 years. U. S. Nav. M. Bull. 34: 300-306, July 1936.

(9) Nichols, F. T., Jr., and Williams, C. J.: Paroxysmal cold hemoglobinuria associated with dementia paralytica; report of treatment with penicillin. J. A. M. A. 140: 1322-1324, Aug. 27, 1949.

Landsteiner test consists of adding guinea-pig complement and the patient's erythrocytes to varying dilutions of his serum. These are then chilled and rewarmed. On rewarming, hemolysis of the patient's cells constitutes a positive test. A similar reaction may be demonstrated with the patient's serum and normal compatible red blood cells of his own blood group, provided complement is added. Hemolysis will not occur if the patient's erythrocytes and normal serum are used. Hemolysis may also be demonstrated by the method of Mackenzie *(5)* in which no complement is added. This is a rough, but generally satisfactory, test in which a test tube containing the patient's clotted blood and another test tube containing blood from a normal control are immersed in ice water for 10 minutes and then rewarmed in a water bath at 37° C. for 30 minutes. Hemolysis will be noted in the patient's serum after the samples are rewarmed.

A corroborative test is described by Rosenbach *(7)* in which the patient's hands and feet are immersed for from 20 to 30 minutes in ice water. After regaining warmth the patient may experience a typical paroxysm with the passage of dark red urine within several hours. Some hazard attends the performance of this test because in certain patients a paroxysm may lead to a shocklike state, with anuria and lower nephron nephrosis.

A less hazardous test is that of Ehrlich in which the finger is bound with a ligature and immersed in ice water for a few minutes. After the finger is warmed, local hemoglobinemia can be demonstrated *(9)*.

That there is a direct etiologic relationship between paroxysmal cold hemoglobinuria of the cold-warm hemolysin type and syphilis is well recognized. Although it has never been reported in connection with or as a counterpart of any other disease, the exact role of the syphilitic process is obscure. Puris *(10)* and others have conclusively shown that the cold-warm hemolysin is separate from the Wassermann reagin. There is no apparent correlation between the titer of the complement-fixation or flocculation tests for syphilis and that of the hemolysin, although both may decrease following antisyphilitic therapy.

The stage of activity of the syphilitic process is important. The coexistence of active clinical syphilis and paroxysmal cold hemoglobinuria is quite uncommon. Of the 38 cases reviewed from the literature up to 1948 and summarized by Becker *(4)*, none showed any clinical evidence of active syphilis and were considered to be in the late latent seropositive stage, acquired or congenital. On the other hand, the finding of the cold-warm hemolysin in patients with late syphilis and without clinical evidence of paroxysmal hemoglobinuria has varied from less than 0.2 to 20 percent *(6)*. In a study by Donath

(10) Puris, A. M.: Paroxysmal hemoglobinuria. Am. J. Dis. Child. 37: 1027-1045, May 1929.

and Landsteiner of 93 patients with dementia paralytica, only 1 patient was found to have paroxysmal cold hemoglobinuria, although 6 others had a positive Donath-Landsteiner test without clinical manifestations of hemoglobinuria *(5)*. Nichols and Williams *(9)* reported an additional case of paroxysmal cold hemoglobinuria associated with dementia paralytica and Glushien *(11)* reported 1 case of 41 years' duration (present since age 9) associated with syphilitic heart disease.

Treatment of the disease consists of treatment of the underlying syphilitic process. Of the 37 cases summarized by Becker, the results of antisyphilitic therapy were reported in 25. This therapy consisted of arsenicals and heavy metals. Fifteen were cured and 10 were improved. Since the advent of penicillin, few cases have been reported. Becker *(4)* reported 1 case treated with 5 million units of penicillin with amelioration of the frequency and severity of the attacks. Nichols and Williams *(9)* reported good results in 1 case associated with dementia paralytica. Goldberg *(12)* reported 1 patient treated with penicillin in whom, although the hemoglobinuria persisted, there was an amelioration of the constitutional symptoms. Wiggall *(13)* reported 4 patients so treated, 2 of whom received no benefit; 1 was well 38 months later; and 1 was improved but continued to have hemoglobinuria only on prolonged exposure to cold. The patient herein reported was treated for congenital syphilis in 1947 with an arsenical, a heavy metal, and penicillin and was treated in 1952 with penicillin with no demonstrable effect on the production of hemolysis both in vivo and in vitro.

CONCLUSION

It is believed that had the patient, here reported, not been exposed to the chilling of a Korean winter while serving with the Armed Forces, his disease would probably have remained clinically unrecognized. One course of arsenical and heavy metal therapy and 2 courses of penicillin had no appreciable effect on the production of clinical symptoms. Similar unrecognized cases probably reside in the Territory of Hawaii, but the clinical expression of their cold-warm hemolysin is suppressed by the mildness of the climate.

(11) Glushien, A. S.: Syphilitic paroxysmal cold hemoglobinuria of 41 years' duration associated with syphilitic heart disease. Am. J. Syph., Gonor. & Ven. Dis. 33: 444-449, Sept. 1949.

(12) Goldberg, L. C.: Treatment of paroxysmal hemoglobinuria with penicillin; report of case. Am. J. Syph., Gonor. & Ven. Dis. 31: 163-165, Mar. 1947.

(13) Wiggall, R. H.: Penicillin treatment of paroxysmal cold hemoglobinuria. Am. J. Syph., Gonor. & Ven. Dis. 31: 450-453, Sept. 1949.

INFECTED URACHAL CYST

EVAN L. LEWIS, *Major, MC, U. S. A. (1)*

JAMES C. KIMBROUGH, *Colonel, MC, U. S. A.(2)*

ALTHOUGH infected urachal cysts of a minor degree are seen frequently they rarely attain the size of the one reported here. The diagnosis in this case was difficult and was made only after permanent microscopic sections were examined 2 days after removal of the cyst. Furthermore, involvement of the bowel and bladder with no external evidence of urachal disease as observed in this case is extremely rare. Tauber and Bloom *(3)* have reviewed the literature on urachal diseases. Cullen *(4)* and Begg *(5, 6)* have presented classic studies on the embryology, symptoms, and diagnosis of urachal diseases.

CASE REPORT

A 24-year-old soldier was admitted to a station hospital because of frequency, urgency, and pain on urination. At the station hospital cystoscopy and biopsy of a bladder lesion were performed. The biopsy specimen showed a transitional cell carcinoma of the bladder and the patient was transferred to Walter Reed Army Hospital on 1 February 1951. At the hospital the general medical work-up was negative. At cystoscopy a flat sessile tumor about 2 cm. in diameter was seen in the dome of the bladder. With the resectoscope a large specimen was taken from the center of the mass. This was reported as carcinoma of the bladder. At the time of cystoscopy, no mass could be palpated by bimanual examination.

On 8 February a segmental resection of the bladder was performed. A midline incision was made from the symphysis pubis to the umbilicus. As soon as the recti muscles were spread, a large, hard mass was felt. This mass extended from the umbilicus downward behind the

(1) Now stationed at the Medical Field Service School, Fort Sam Houston, Tex.
(2) Walter Reed Army Hospital, Washington, D. C.

(3) Tauber, J., and Bloom, B.: Infected urachal cysts. J. Urol. 66: 692-696, Nov. 1951.
(4) Cullen, T. S.: Embryology, Anatomy, and Diseases of the Umbilicus, Together With Diseases of the Urachus. W. B. Saunders Co., Philadelphia, Pa., 1916.
(5) Begg, R. C.: Colloid tumour of urachus invading bladder. Brit. J. Surg. 23: 769-772, Apr. 1936.
(6) Begg, R. C.: Urachus; its anatomy, histology and development. J. Anat. 64: 170-183, Jan. 1930.

symphysis. From all appearances there was no doubt but that this was a carcinoma of the urachus involving the bladder. Previous experience with this disease has been such as to warrant a try at radical removal. The incision was carried above and around the umbilicus and the peritoneum was opened. The tumor was found to be attached to the whole anterior peritoneum, part of the rectus muscle, and the fascia in the midline. This was all removed with the tumor. As the tumor was elevated it became apparent that the omentum was involved as well as the terminal ileum and bladder. The omentum was, therefore, resected. The terminal ileum and part of the ascending colon were resected from a point just above a Meckel's diverticulum, which was not involved, to the midportion of the ascending colon.

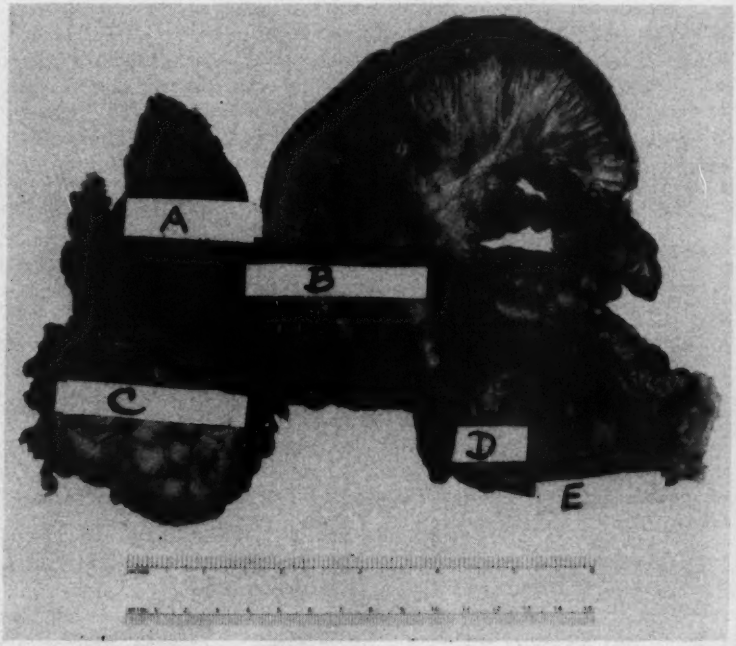

Figure 1. (A) *Urachal carcinoma.* (B) *Invading terminal ileum.* (C) *Invading dome of bladder.* (D) *Cecum.* (E) *Ascending colon.*

An ileocolostomy was performed. The tumor was then dissected down to the bladder and a segment of bladder about 2 cm. from the tumor was resected. The bladder was closed around a mushroom catheter. It was impossible to close the peritoneum so the omentum was used to cover the intestines and the abdomen was closed with stainless steel stay sutures. The pelvis was drained with Penrose drains.

Recovery was uneventful and the patient was returned to duty after 2 months. Figure 1 shows the specimen as it was removed in one piece. At the time the photograph was made it was still believed that this was a carcinoma.

The pathologists made many sections from numerous blocks but were unable to find anything resembling carcinoma. They agreed that this represented a long-standing infection which by erosion and invasion had come to involve the peritoneum, anterior wall of the pelvis, terminal ileum, omentum, and bladder. Review of the bladder biopsy slides was made and the diagnosis changed to reaction to infection. Following recovery, the patient was thoroughly questioned concerning umbilical discharge, bowel symptoms, pains in the abdomen, et cetera, but none could be elicited. This case is interesting from the standpoint of diagnosis and treatment as well as its uniqueness.

BOOK REVIEWS

A Textbook of Histology, by *Alexander A. Maximow*, Late Professor of Anatomy, University of Chicago, and *William Bloom*, Professor of Anatomy, University of Chicago. 6th edition. 616 pages; 986 illustrations, 257 in color, on 580 figures. W. B. Saunders Co., Philadelphia, Pa., publisher, 1952.

Included in this edition are the significant advances in histology since the publication of the fifth edition in 1948. Notable among the improvements and additions are the greater number of color photomicrographs, illustrations of phase and electron microscopy, and the reorganization and revision of chapters on connective tissue, blood cell formation and destruction, cartilage, and endocrine glands. The background material has been carefully selected and excellently presented to document and enlarge concepts of the functional aspects of structure, particularly as regards the application of newer technics of electron and phase microscopy and histochemical methods. The bibliography reflects a judicious selection of basic contributions to the subject. All illustrations have been reoriented so that the reader does not have to turn the book to read legends. Except for a few detailed illustrations on organs of special sense, labels are used for figures instead of abbreviations. The print is easier to read than that used in the previous edition. The index is complete. This recognized and authoritative text is highly recommended to medical students, histologists, and pathologists.

—*Maj. T. R. Anderson, MC, U. S. A.*

Renal Function, Transactions of the Third Conference, October 18-19, 1951, New York, N. Y., edited by *Stanley E. Bradley,* Department of Medicine, College of Physicians and Surgeons, Columbia University. 210 pages; illustrated. Sponsored by the Josiah Macy Jr. Foundation, New York, N. Y. Price $3.50. Printed in the United States of America by Corlies, Macy and Co., Inc., New York, N. Y.

The purpose of the conference here reported was to discuss the difficulties encountered in research and practice. Leading authorities in the field of renal function presented their ideas and defended them against the challenges of other participants at the conference.

Filtration and diffusion are defined. The differences in these physical processes are described. The pore theory and the gel theory of filtration are discussed and challenged at length and it is concluded that most substances cross capillary membranes by a process of diffusion rather than by filtration.

Attempts are made to reconcile the different values of intrarenal pressure which have been obtained by the several experimental technics. There follows an excellent presentation of the physical factors related to electrolyte and water excretion in which it is concluded that there is probably no maximal tubular excretory capacity for sodium in contrast to other substances. Elaborate discussion is made of how the variations in arterial pressure, venous pressure, and ureteral pressure influence sodium excretion.

The last 3 chapters deal with the use of the artificial kidney, tubular secretion of potassium and acid, and the enzymatic processes in tubular secretory transport. The artificial kidney is discussed in regard to (1) its fundamental construction from cellulose membrane (which is the same as that used for frankfurter casings), (2) the comparison of this membrane in pore length and radius to the membrane of the glomerulus, and (3) factors of its operation and clinical application. The mechanism of the tubular secretion of potassium and acid is fully elaborated and the important role of carbonic anhydrase in this function is shown by reference to the results of experimental work. A new drug, number 6063, which is an inhibitor of carbonic anhydrase, is discussed. Evidence is presented to show that the carboxyl group is the most probable reactive group related to the active tubular transport of various compounds.

This book is recommended for all who are interested in the fundamental problems of renal function. It gives the opinions of leaders in this field of scientific work. It requires a knowledge of mathematics and chemistry for complete understanding, but it forcefully presents the fundamental problems and the basic work accomplished in describing the function of the kidney.

—*Commander H. A. Lyons, MC, U. S. N.*

ONLAY TANTALUM MESH

An Emergency Replacement of an Abdominal Wall Defect

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SELLERS J. THOMAS, JR., *Lieutenant, MC, U. S. N. R. (1)*
JOHN M. THOMPSON, *Lieutenant, junior grade, MC, U. S. N. R. (1)*

TANTALUM mesh has served a multiplicity of purposes in replacing absent or attenuated human tissues. It is the intent of this article to discuss only its use in total defect of the abdominal wall. Koontz *(2)* employed the mesh in direct contact with the bowel wall with only mild adhesions, nonproductive of obstruction. He stated that its use is satisfactory in the presence of infection although buried silk or cotton sutures are contraindicated because of resultant sinus formation. Crile and King *(3)* successfully used tantalum mesh to repair a large surgical defect in a patient with malignancy. It was impossible to close the peritoneum but the skin was approximated. In a similar case, Bussabarger et al. *(4)* effected a peritoneal closure and the tantalum was left partially exposed. In the following case report of a defect of the abdominal wall, the mesh was placed directly over omentum without further closure.

CASE REPORT

A 39-year-old Negro was shot in the right side of the abdomen with a 410 shotgun at close range. He was admitted to this hospital on 17 September 1951, 1 hour after injury, at which time he was in fair condition and presented a large wound of entrance above the right anterosuperior iliac spine from which bloody feces issued. Fluids and blood were given intravenously and as soon as the vital signs stabilized he was taken to surgery. At operation through a right paramedian incision, multiple perforations of the anterolateral cecal wall were seen.

(1) U. S. Naval Hospital, Corpus Christi, Tex.

(2) Koontz, A. R.: Tantalum mesh in hernia repair. J. Internat. Coll. Surgeons 15: 748-753, June 1951.

(3) Crile, G., Jr., and King, D. E.: Successful use of tantalum mesh to repair an abdominal wall defect in presence of massive fecal contamination; report of case. Surgery 29: 914-916, June 1951.

(4) Bussabarger, R. A.; Dumouchel, M. L.; and Ivy, W. H.: Use of tantalum mesh to repair large surgical defect in anterior abdominal wall. J. A. M. A. 142: 984-985, Apr. 1, 1950.

After packing this off, the remainder of the abdominal contents were examined. Multiple small perforations were seen in a 10 cm. segment of the jejunum 60 cm. from the ligament of Treitz. This segment was resected and an end-to-end anastomosis in 2 layers was accomplished. The involved cecal wall was brought through the operative wound and loosely sutured to the peritoneum and posterior sheath, thus excluding the wound of entry from the abdominal cavity. The latter was debrided and packed loosely with petrolatum gauze.

The immediate convalescence was complicated by massive atelectasis which responded to intratracheal aspirations. Sloughing of the presenting anterolateral cecal wall occurred and this was debrided. The ileocecal valve was then seen protruding into the depths of the open bowel. One month later an extraperitoneal closure of the exteriorized cecal wall was performed under slight tension. In doing this, an adjacent adherent loop of small bowel was injured and repaired. Normal bowel movements ensued, but 4 days later the cecostomy closure began to leak and subsequently opened. Six days thereafter, it was noted that the small bowel, previously mentioned as having been injured, began discharging liquid feces. The patient lost large amounts of fluid and his condition deteriorated in spite of fluid, electrolyte, and blood administration. In an attempt to improve the patient's condition, a temporary approximation of the friable margins of the small bowel fistula was performed at the bedside. Forty-eight hours later the patient's condition had improved somewhat, but it was seen that the fistula was reopening. He was immediately taken to surgery.

At operation, the cecostomy wound was excluded from the field and a long midline incision was made. After separation of numerous adhesions and loops of ileum, it was found that the small bowel fistula was in an adherent loop of jejunum at some distance from the former anastomosis. This was dissected free from within, and the resultant defect closed transversely in 2 layers. The cecum was then freed and an elliptical defect was found involving the entire anterior and lateral walls. The cecum was closed transversely in 3 layers with moderate difficulty. In order to accomplish this, it was necessary to remove the appendix, the stump presenting anteriorly after the approximation. A mushroom catheter ileostomy 16 cm. from the ileocecal valve was brought out through a stab wound to the left of the midline.

The incision was closed with through-and-through interrupted double steel wire No. 32. On removal of the occlusive dressing over the former cecostomy, it was found that an irregular circular abdominal wall defect measuring 8 by 11 cm. remained. The tissue about the defect was rigid, edematous, and inflamed and there was some digestion of the surrounding skin due to the discharge of the previous jejunal fistula. In addition there was moderate distention and loops of bowel tended to extrude. Laterally, a bridge of abdominal wall 2.5 cm. in width separated the above opening from the old wound of entrance which was practically closed by depressed scar tissue.

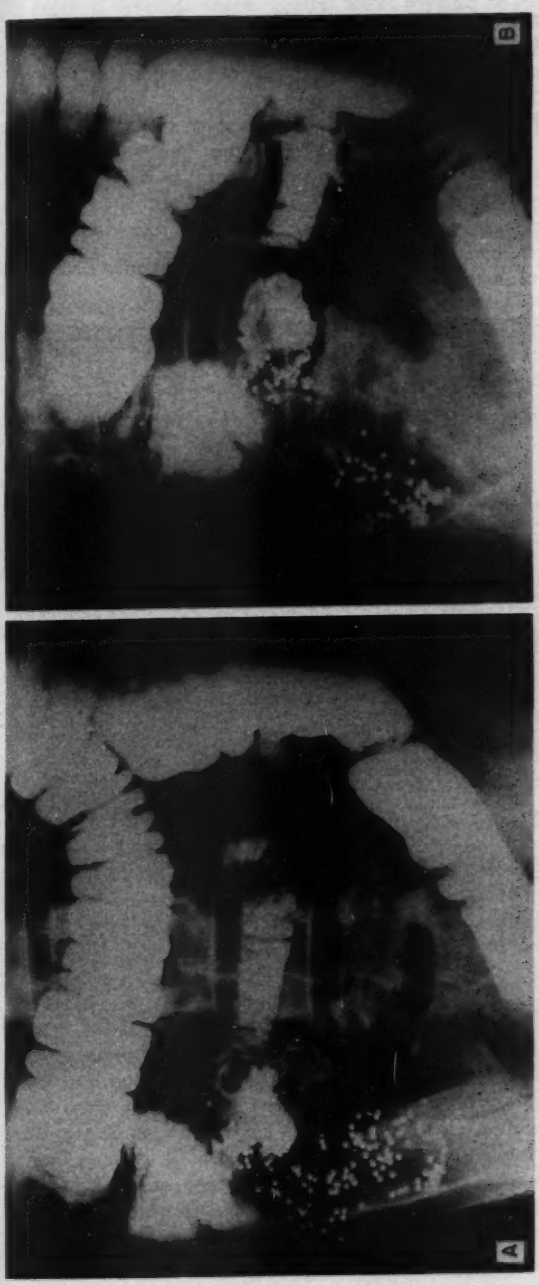

Figure 1. Roentgenograms taken after barium enema. (A) Anteroposterior view. (B) Lateral view.

At this point the anesthetist reported that the patient's condition did not warrant prolonged operation. As neither the peritoneum nor the margins of the wound could be approximated, a rapid means of closure had to be found. Open loose packing was considered, but discarded because it would favor adhesions with resultant obstruction and recurrence of fistula. Therefore, a sheet of omentum was tacked around the margin of the undersurface of the wound. Tantalum mesh (type 50 mesh, 0.003 inch) was laid on the wound in contact with the omentum and sutured with through-and-through No. 00 silk sutures about the periphery. The mesh had been trimmed to allow a slight overhang. A petrolatum gauze pressure dressing was applied.

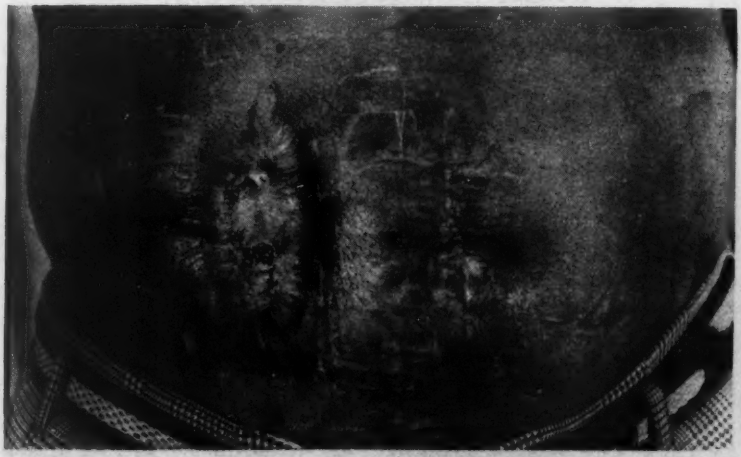

Figure 2. Here the area of the mesh is covered with thin split-thickness skin grafts which have broken down over a small area. There is no weakness of the abdominal wall at or about the mesh.

There were no postoperative complications. On the fifth postoperative day when the dressing was first changed, granulation tissue was found to have grown up through the mesh so that only the turned up margins were visible. On the eighth postoperative day the silk sutures were removed and the edges of the mesh were trimmed down to the level of the granulation tissue. It was noted in the next few weeks that the tissues about the tantalum mesh progressed to normalcy. There was epithelization about the margins and a tendency for gradual contraction to approximate the 2 sides. This resulted in pushing out the margins of the mesh which was further trimmed. Figure 1 shows the presence of the tantalum mesh after numerous trimmings. The barium enema shows the deformity of the remaining cecum after intraperitoneal closure. The remarkable thing here was the absence of injury to the right ureter which might easily have been severed by one or more of the shots.

After 6 weeks, pinch grafts were applied to the granulating area with resulting satisfactory epithelization over the entire wound. There was no evidence of abdominal wall weakness in the region of the tantalum mesh. It was noted that as a result of ingrowth and contraction, the final width of the remaining mesh had diminished to 4 cm. from its original 8 cm., but the vertical dimension lost less in proportion. The grafted area broke down (fig. 2). Apparently fibrous tissue replaced the granulations within the mesh obliterating the vascular supply. The mesh was excised and the clean healthy margins were approximated with through-and-through steel wire No. 32 interrupted sutures (fig. 3). Healing was prompt.

The pathologist reported that the specimen consisted of an ellipse of dark-colored, scarred skin which measured 7.5 by 3.5 by 1 cm. Section showed dense wire mesh throughout the tissue surrounded by white scar tissue. Microscopic sections of the tissue adjacent to the tantalum wire mesh showed it to be partially covered by stratified squamous epithelium. Beneath the epithelium there was very dense fibrous tissue which in some places showed a focal collection of

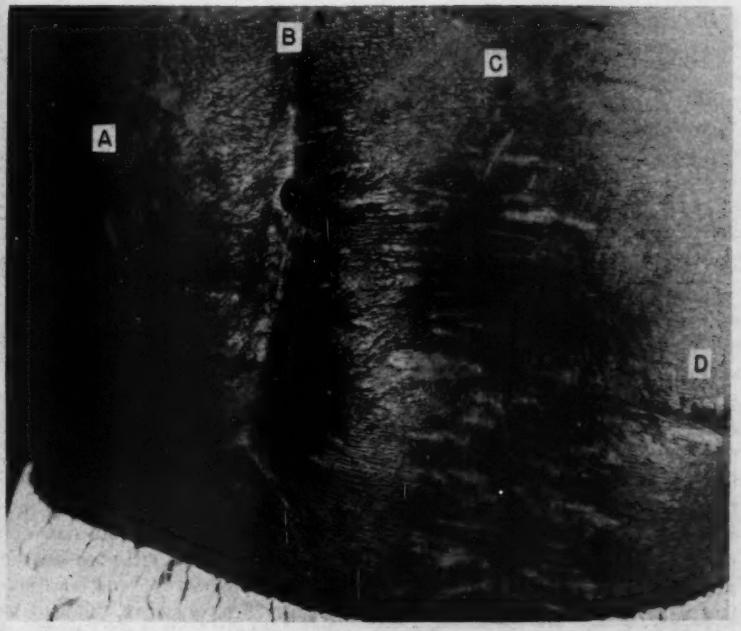

Figure 3. Four scars are visible: (A) *Laterally the depressed scar of wound of entry.* (B) *The closure following removal of the tantalum mesh. A small circular granulation at the upper third which was healed on discharge 3 days after this picture was made.* (C) *The midline healed scar.* (D) *The scar of the ileostomy wound to the left of the midline.*

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lymphocytes and plasma cells and a few scattered neutrophils. There was no evidence of malignancy. A tissue diagnosis of foreign body reaction to tantalum wire mesh was made.

COMMENT

In a wound with more satisfactory margins, it would be preferable to place the edges of the tantalum mesh in the deeper tissues rather than to use it as an onlay as we did. Because of its great vascularity an omental bed appears to give more rapid and more uniform granulation through the mesh than does parietal peritoneum. In this patient the grafting stage could have been omitted and the mesh removed with closure at an earlier date.

Tantalum mesh is indicated (1) in the presence of infection and/or tension with a defect too large for simple closure, and (2) where, as the result of a battle wound, a large abdominal wall defect is present and it is impracticable to spend the time necessary for plastic closure because of the poor condition of the patient.

BOOK REVIEW

The Human Pelvis, by *Carl C. Francis*, A. M., M. D., Assistant Professor of Anatomy, Department of Anatomy, Western Reserve University, Cleveland, Ohio. 210 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., publisher, 1952. Price $5.

This book was evidently the result of inquiries of the students in the course of applied anatomy. The bones, articulations, muscles, blood supply, and nerve supply of the pelvis are covered minutely. This book is designed for gynecologists and surgeons, but urologists and orthopedists would profit from some of the material. The mechanics of the transmission of weight from the lumbar spine to the pelvic bones is thoroughly described and explains some of the causes of low back pain. The chapter on the pelvic girdle, based on the measurements of live pelves and material in the anatomic collections of many universities, should be valuable to obstetricians. This book is recommended for all those whose practice demands a knowledge of the pelvis, its supports, its nerves, and its contents.

—*Commander E. P. McLarney, MC, U. S. N.*

TRAUMATIC DIAPHRAGMATIC HERNIA

DAVID E. THOMAS, *Lieutenant Colonel, MC, U. S. A.*

SINCE the development of roentgenology, diaphragmatic hernia has become a clinically recognizable entity. Although most of the cases are congenital or acquired, hernias of traumatic origin occur with sufficient frequency to be worthy of note. These may result from missile wounds, stab wounds, inadequate postoperative healing, or following indirect violence such as falls or crushing injuries with marked temporary increase in intra-abdominal pressure.

When resulting from indirect violence, the hernia usually occurs in the left leaf of the diaphragm and extends from near the neighborhood of the esophageal hiatus peripherally in any radius to the left from that point *(1)*. Early signs and symptoms may be minimal or masked by associated injuries, as in the case here reported, delaying the diagnosis. When symptoms are present they include shock, pain in the left upper abdominal quadrant, the left side of the thorax, and the left shoulder, and dyspnea and cyanosis may occur. On physical examination, dullness or tympany, borborygmi, and peristaltic sounds may be heard in the left side of the chest. The mediastinum may be shifted to the right.

During the interval phase, the diagnosis may be made while complaints suggestive of peptic ulcer or coronary disease, such as discomfort after eating, vomiting, or feeling of substernal compression, are being investigated *(1)*. Intestinal obstruction or strangulation is the complication to be feared in this disease and its diagnosis without roentgenography is difficult because of a lack of findings in the abdomen if the obstruction is high. Operation on patients with such complications results in a high mortality, but a failure of prompt diagnosis and treatment is invariably fatal *(2)*.

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(1) Carter, B. N.; Giuseffi, J.; and Felson, B.: Traumatic diaphragmatic hernia. Am. J. Roentgenol. 65: 56-72, Jan. 1951.

(2) Kushlan, S. D.: Strangulated right diaphragmatic hernia with surgical cure. Gastroenterology 18: 466-477, July 1951.

CASE REPORT

A 24-year-old paratrooper was admitted to the 8162d Army Unit in January 1952 complaining of pain in the abdomen. After his initial work-up the ward officer's tentative diagnosis was peptic ulcer. The patient was x-rayed before a complete history was obtained, and on the basis of the roentgenographic findings a more complete history was obtained and a more complete physical examination was performed.

The history revealed that in October 1951 he had made a difficult landing on a parachute jump and was unconscious for 24 hours. He was in bed for 3 weeks and spent a total of 4 weeks in the infirmary of his unit. Three days following injury he began experiencing dull, intermittent pain in the left upper abdominal quadrant. This would last for about 1 hour every 2 or 3 days. He described it as feeling as if he were constipated. He had no shortness of breath, vomiting, or melena. He was returned to duty in the latter part of November and on the basis of his persistent abdominal pain, he was referred to the hospital in January.

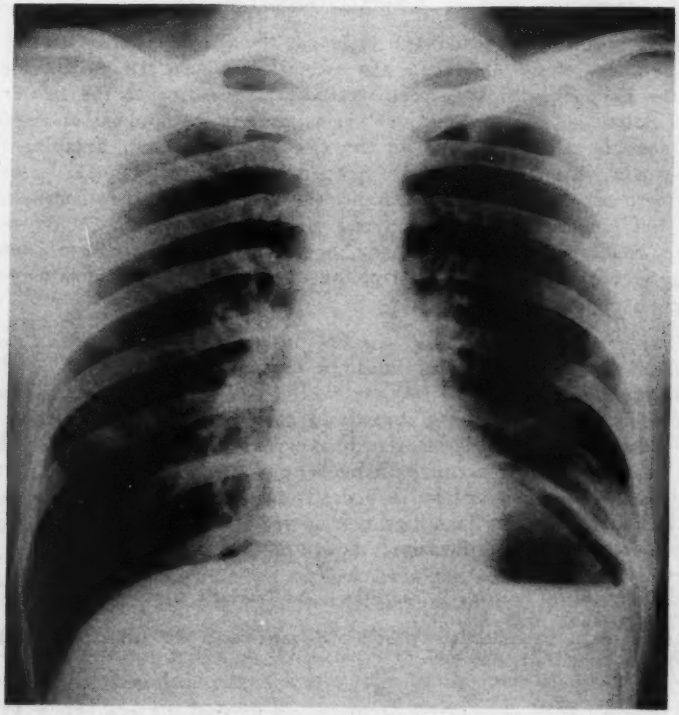

Figure 1. Roentgenogram taken on admission. At this time a diagnosis of eventration of the left leaf of the diaphragm was also considered.

Figure 2. Roentgenogram following barium meal showing the esophageal hiatus intact and the stomach and small bowel in the left hemithorax. Figure 3. Roentgenogram following barium enema showing the colon in the left hemithorax. Note constriction of the colon at the site of the diaphragmatic defect.

On physical examination decreased breath sounds were heard in the base of the left lung. Peristalses could be heard in the left side of the chest. The roentgenograms are shown in figures 1-3.

The patient was operated on on 4 February through a left upper abdominal quadrant transverse incision which could have optionally been converted into a thoraco-abdominal incision if necessary. A large rent was found extending from near the esophageal hiatus through the dome of the left leaf of the diaphragm. The transverse and descending colon, a major portion of the jejunum, the stomach, and the left lobe of the liver were found to be in the left thoracic cavity. The hernia was reduced and the viscera were packed off with relative ease, the edge of the defect was trimmed to promote healing, the defect was closed, and the suture line was reinforced by the triangular ligament of the liver, which was freed from its left lobe.

The postoperative course was uneventful. Five hundred cubic centimeters of air and 75 cc. of old blood were removed from the left hemithorax on the first postoperative day and no further thoracenteses were necessary. A roentgenogram of the chest on 29 February was essentially negative, with the diaphragmatic excursion on the left side one-half of that on the right side. The soldier was returned to full military duty with the exception that further parachute jumping was prohibited because it was believed unwise to subject a scarred diaphragm to the trauma of the shock of the opening parachute.

COMMENT

One might presume that an injury of this nature would not be uncommon among men exposed to the trauma incident to parachute jumping. In 4 years as a unit surgeon with various parachute infantry regiments during World War II, however, I encountered no patients with this injury. This would indicate that it is rare.

The diagnosis in this case was made by the roentgenologist, but I believe a higher degree of suspicion, a more careful history, with particular attention to the chronologic order of events, and a complete physical examination by the clinician who referred the patient could have led to a consideration of the correct diagnosis.

In the repair of traumatic diaphragmatic hernias, the midline abdominal, thoracic, and combined approaches have been recommended by various authors (*1*, *3*). It is my opinion that this lesion is best approached through a transverse incision in the vicinity of the eighth or ninth rib in the left upper abdominal quadrant. Through the exposure obtained the reducibility and reparability of the hernia may be determined. If repair is not possible through this incision, it is a simple matter to continue the incision along the rib and convert to a thoraco-abdominal approach.

(*3*) Harrington, S. W.: Symposium on abdominal surgery; traumatic diaphragmatic hernia. S. Clin. North America 30: 961-970, Aug. 1950.

BRUXISM [1]

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GERALD H. BESEN, *First Lieutenant, U. S. A. F. (DC)*
RUSSELL H. ARMSTRONG, *Major, U. S. A. F. (DC)*

PATIENTS may habitually grind their teeth (bruxism) during their sleeping hours, during their daytime activities, or both. Bruxism is usually associated with gastrointestinal disorders or physical or emotional stress. These patients, even though they may be unaware of the habit, usually complain of a stiffness in the muscles of mastication or a soreness of the teeth on awakening in the morning. Grinding the teeth results in marked dental attrition with the subsequent loss of contact points. This permits food impaction and the facets worn in these teeth may cause a tripping in mandibular excursions, resulting in overloading the periodontal structures and subsequent periodontal destruction due to abnormal occlusal stress. Ingersoll and Kerens [2] reported that in the resting position the teeth are apart and no force is applied; therefore, occlusal trauma results only when the teeth are occluded at periods other than when food is masticated. When teeth are worn down rapidly the patient may feel pain from temperature changes and the chemical reaction of food.

One of the simplest and most effective ways to counteract the ill effects of bruxism is the protection of the teeth by means of splints to be worn at night. The slight opening of the bite maintained with splints prevents further wear of the incisors and relieves the occlusal trauma which produces periodontal destruction and consequent tooth loss.

In a recent dental survey conducted at this base, the prevalence of bruxism among both flying and nonflying personnel was noteworthy. As we were dealing chiefly with young adults, the immediate treatment and alleviation of this pernicious habit was of utmost importance. A complete history, oral examination, and set of dental roentgenograms were obtained on each patient.

CASE REPORTS

Case 1. A 21-year-old dental technician complained that his front teeth were very sensitive to temperature changes and to sweets and that his front teeth were shorter than those of other men of his age. On close questioning, he admitted that his mother had told him on numerous occasions that he ground his teeth at night. He stated that his teeth

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[1] United States Air Force Hospital, Larson Air Force Base, Wash.

[2] Ingersoll, W. B., and Kerens, E. G.: Treatment for excessive occlusal trauma or bruxism. J. Am. Dent. A. 44: 22-26, Jan. 1952.

frequently ached in the morning. Examination revealed a well-cared-for mouth. Generalized simple gingivitis was present. Slight labial recession of his gums in the mandibular anterior region was noted. No periodontal pockets were found. Marked attrition of his mandibular anterior teeth with facets on his mandibular cuspids was evident. He had a marked anterior overbite and closed bite. Roentgenograms revealed pulp recession in his mandibular anterior teeth. There was a vertical pocket (2 mm. deep) between his maxillary right cuspid and first premolar.

The treatment consisted of a thorough prophylaxis and subgingival curettage on the periodontally involved teeth. A combination rubber and acrylic splint was constructed. The acrylic was used to form the skeletal framework of the splint and the rubber was used to eliminate trauma. Because the amount of rubber used was kept to a minimum, the disagreeable odor and taste to the patient was almost completely eliminated and still an even distribution of force over the area covered was attained.

The acrylic-vulcanite splint was constructed as follows. Alginate impressions of the maxillary and mandibular teeth were taken, care being exercised to include the mylohyoid and sublingual areas in the lower impression. Stone models were poured immediately. All the undercuts on the mandibular teeth were blocked out with undercut wax and duplicate models were poured in stone. The duplicate models were then mounted on an articulator. Twenty-eight-gage wax was adapted on the occlusal surfaces of the mandibular posterior teeth. One and one-half thicknesses of baseplate wax were adapted to cover the buccal surfaces of the teeth. On the lingual surfaces the wax was extended to correspond to the limit of the average full lower denture. One thickness of baseplate wax was adapted to the occlusobuccal and occlusolingual thirds of the posterior teeth on the buccal and lingual surfaces, extending vertically to a height of 1 mm. above the occlusal surfaces. These vertical wax extensions were undercut to give added retention for the subsequent placement of rubber.

Stainless steel pins were inserted buccally and lingually through the baseplate wax until the occlusal thirds of the teeth were encountered. The pins were extended so that they could be subsequently grasped by the plaster investment. They served as added retention for the vulcanite. The flasking procedure was that employed for full dentures. The wax was then boiled out in the usual manner, care being taken not to disturb the plaster covering the pins. A tin foil substitute was painted on both halves of the flask. The acrylic resin was then packed in the flasks using the method employed in packing a full lower denture. The case was then processed at 158° F. for 1 hour and at 212° F. for 30 minutes. It must be remembered that the splint is processed on the cast. Deflasking was carried out in the usual manner. The acrylic was not polished at this time. The area to be used for retention of the vulcanite, e. g., vertical extension above the occlusal surfaces of the mandibular posterior teeth, was undercut again with a No. 701 tapered fissure bur.

The master models were then articulated and the lower splint was placed on the model to check for distortion. The occlusal surfaces of the posterior teeth were waxed using 1 mm. of low melting wax. The articulator was closed and held firmly, the maxillary teeth being forced through lateral and protrusive movements in order to assure adequate pathways for the maxillary teeth with the minimum amount of resistance and subsequent trauma. Care was taken not to open the bite more than 2 mm. on the articulator. The acrylic splint with the wax on the occlusal surfaces of the posterior teeth was tried in the mouth to check for the amount of bite opening and also to eliminate any lateral interference. The splint was then placed on the master model, put in a flask, and the entire splint with the exception of the low-melting occlusal wax was covered with plaster. The wax was boiled out in the usual manner and while the flask was hot, rubber was packed on the occlusal surfaces of the splint.

Several trial packs were made to assure that enough rubber was being used. The rubber was partially cured by bringing the flask up to the boiling point slowly and then maintaining it at this temperature for 2 hours. The flask was bench-cooled for 15 minutes and cooled under tap water for 20 minutes. Both the occlusal vulcanite surfaces and the acrylic skeleton of the splint were then polished in the usual manner (figs. 1 and 2). The patient was instructed to wear this splint only at night. The splint had excellent retention; no clasps were used and it

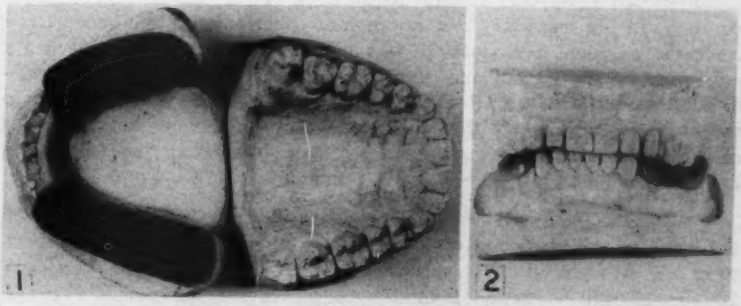

Figure 1. Combination vulcanite-acrylic splint covering buccal surfaces of posterior teeth and extending into mylohyoid and sublingual areas. Figure 2. Articulated models with splint in place.

was well tolerated by the patient. It was also economical to make and could be constructed with a minimum of laboratory facilities. It consequently has become the most commonly used splint at this base.

Case 2. A 33-year-old butcher stated that he habitually ground his teeth while concentrating on his work, while playing baseball, and during sleep. He had a generalized marginal gingivitis. There was a moderate amount of gingival recession on the labial surfaces of the mandibular anterior teeth and on the buccal and lingual surfaces of the maxillary and mandibular posterior teeth. This was more marked on the buc-

cal surfaces of the posterior teeth (maxillary and mandibular) on the left side than on the right. There was marked attrition of the mandibular anterior teeth and over the incisal edges of these teeth hyalinized dentine was present. A moderate amount of attrition was present on the occlusal surfaces of all the maxillary and mandibular posterior teeth. This man had an extremely closed bite and a marked anterior overbite.

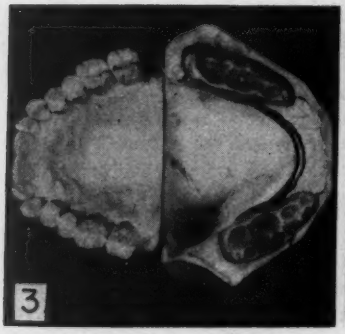

Figure 3. Splint covering mandibular posterior teeth. Figure 4. Articulated models showing relationship of maxilla and mandible with splint in position.

Full-mouth periapical roentgenograms revealed marked recession of the pulp in the maxillary and mandibular anterior teeth. A generalized moderate marginal periodontitis was present with vertical pockets 1.5 mm. deep on the mesial and distal surfaces of the maxillary and mandibular posterior teeth. Pockets about 1.5 mm. deep were present in the proximal surfaces of the upper and lower anterior teeth. Resorption of the alveolar crest was most marked in the maxillary and mandibular anterior regions.

It was decided to make this airman a mandibular splint to alleviate not only his bruxism but also to aid our program of periodontal treatment. A wrought-gold lingual bar with wrought-gold clasps on teeth 20 and 29 formed the skeleton of the splint. Acrylic onlays covering the occlusal thirds of all the mandibular posterior teeth were processed on the gold framework. The missing teeth were restored with acrylic replacements (figs. 3 and 4). The bite was opened 1.5 mm. The patient was instructed to wear the splint while engaged in cutting meat, pitching baseball, and during sleep. Consequently he no longer experienced the feeling of soreness in his face which he previously had.

A splint of this design must be carefully observed to make sure that excessive pressure is not transmitted to the clasped teeth with resultant trauma because this appliance is worn for such long periods of time. Our patient wore this splint for 6 months with no apparent difficulty clinically or radiographically.

Case 3. A 29-year-old man stated that he ground his teeth so loudly during sleep that in World War II his roommate was frequently awakened. He had consulted a medical officer and was informed that the cause of this condition was nervousness and that it would disappear. In 1945 he married and his wife told him that whenever he was fatigued or had performed some strenuous duty, he ground his teeth while asleep. His chief complaint on reporting for examination was that his face ached and his teeth felt like "lead weights" on awakening. He had a generalized marginal gingivitis. There was marked attrition of his mandibular and maxillary anterior teeth. There was moderate attrition of the occlusal surfaces of his maxillary and mandibular posterior teeth. He had a marked anterior overbite and an extremely closed bite. Roentgenograms showed recession of the pulp in all the teeth and especially in the maxillary and mandibular anterior teeth. He had a generalized moderate marginal periodontitis. Vertical pocket formation was evident throughout his mouth. Alveolar resorption was more marked in the posterior teeth.

A mandibular splint was constructed in an effort to alleviate the excessive occlusal trauma in addition to routine periodontal treatment. A cast, gold, lingual bar and skeleton with cast clasps on teeth 20 and 30 was constructed. A No. 701 tapered fissure bur was used to make suitable undercuts to receive the rubber on the occlusal portion of the skeletal framework of the splint. The biting surfaces were made of partially cured rubber. This splint covered the occlusal thirds of the mandibular teeth (figs. 5 and 6). The patient was instructed to wear this splint at night. He experienced immediate relief from his symptoms. Unfortunately we could only observe him for 4 months.

Figure 5. Splint with cast, gold, skeletal framework and vulcanite biting surfaces. Figure 6. Occlusal relationship with splint in position.

SUMMARY

Grinding of the teeth at night and clenching the teeth during the day may result in irreparable periodontal destruction. Mandibular splints are of value in the treatment of this condition, the splint of choice being a combination of acrylic and vulcanite covering the buccal surfaces of the mandibular posterior teeth and lingually extending as far as the outline of a full lower denture anteriorly and posteriorly. This type of splint is well tolerated, requires no clasps, is economical, has excellent retention, and eliminates excessive occlusal trauma.

BOOK REVIEW

Ultraviolet Radiation, by *Lewis R. Koller,* Ph. D., Research Associate, General Electric Research Laboratory, Schenectady, N. Y. 270 pages; illustrated. John Wiley & Sons, Inc., New York, N. Y., publisher, 1952. Price $6.50.

The first chapter defines and discusses ultraviolet radiation. Basic physics is presented and details on the erythemal unit are given. Chapter 2 deals with the sources and means of production of ultraviolet light from arcing and their physical characteristics. The third chapter discusses the incandescent lamp as a poor source of ultraviolet. Chapter 4 deals with solar radiation and gives details on the modification of ultraviolet light by atmospheric conditions, sky radiation, seasons of the year, and altitude. There is a short discussion of the ultraviolet limits of direct sunshine with a table of calculated values of ultraviolet intensity for different values of air mass. Chapter 5 takes up the transmission of ultraviolet light by various physical agents such as glass, pyrex, corex, vycor, quartz, calcite, fluorite, rock salt, plastics, water, air, and skin. The sixth chapter deals in the same manner with agents of reflection of ultraviolet light. The seventh chapter is the most important in the book from a medical viewpoint. It deals with the practical applications and effects of ultraviolet light. The final chapter is concerned with the measurement and detection of ultraviolet light.

There are many detailed tables of physical characteristics scattered throughout the book. This book was primarily intended to answer some of the questions which confront physicists and specialists in fields other than physics. The general medical practitioner would have little use for this book, but it is recommended to those physicians who use ultraviolet light either clinically or experimentally.

—*Lt. Comdr. G. E. Vaupel, MC, U. S. N.*

NAVY FOOD SERVICE STANDARDS AND TRAINING[1]

ROBERT M. CAIN, *Lieutenant, junior grade, MSC, U. S. N. R.*

FOR the past several years, the Navy has been doing considerable work in the field of sanitation, with particular regard to the problem of food handlers. The definition of food handlers includes any personnel who are connected with the preparation and serving of food, or with the cleansing of used eating utensils and cooking equipment.

It has been shown that properly trained personnel can obtain acceptable sanitary results with mediocre equipment, but acceptable results cannot be obtained from good equipment operated by improperly indoctrinated personnel and under inadequate supervision. The machine is no better than the person who operates it. Many factors enter into the picture when personnel are involved. These include personal hygiene, working conditions, training, and even the psychologic effects of being supervised.

In order to determine just how the naval program is being operated, the annual sanitary reports for the year 1950 were reviewed, with particular emphasis on the personnel involved and the general sanitary conditions prevailing in the galleys of the ships reporting. The results are summarized in table 1. This classification of reports was the simplest that could be made. Though the reports conformed to standard outlines, they were in many cases based on local interpretations or inadequately covered, so that I had to draw my own conclusions from the varied data given. The arbitrary categories are defined as follows:

Ships reporting poor equipment.. Those that mentioned obsolete equipment, deteriorated sinks, lack of proper temperature controls, or improper storage facilities for cleansed eating utensils.

Ships reporting fair conditions. This classification was used as a catchall for indicating such conditions or items as breakdowns and rather frequent interruptions for repairs of equipment, as well as minor insanitary conditions that were undergoing correction.

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(1) U. S. Naval Medical School, National Naval Medical Center, Bethesda, Md.

Ships reporting good conditions. This classification was used to indicate that sanitary conditions were acceptable from the viewpoint of the officer or medical department representative making the sanitary report. It does not, however, mean that all ships making a satisfactory report had mechanical equipment on board for washing dishes. In some cases where the dishes were washed by hand, they were boiled for 30 minutes or more, which though time-consuming, is certainly an acceptable method of obtaining sanitary eating utensils.

TABLE 1. *Review of sanitary conditions in ships' galleys, 1950*

Conditions reported	*Fleet (percent)*	*MSTS* (percent)*
Poor equipment	10.21	7.04
Fair conditions	8.81	14.08
Good conditions	63.36	66.20
Incomplete report	17.62	12.68

*Military Sea Transport Service.

Ships making incomplete report. This is perhaps an unjust classification. It is used merely to show the percent of ships making reports outlining procedures but failing to comment on the relative effectiveness of the methods used. Reports listing procedures that were found to be in general agreement with dishwashing procedures set forth in USPH Bulletin 280 were, however, not placed in this category, but in "Ships reporting good conditions."

As an additional comment on the general practices connected with food handling and dishwashing, it is gratifying to note that in most instances the personnel involved in these procedures were examined at least once a week and sometimes as often as once a day for any signs of diseases as well as for personal cleanliness and appearance.

Generally speaking, even when a report was placed in an unsatisfactory category because of improper equipment, et cetera, it was noted that intense efforts were being made to correct all conditions that were considered to be unsatisfactory.

Narrowing the observations to the subject of personnel involved, fleet food handlers' reports were examined to determine just what class of person was given supervision over food handlers' jobs and just how much training personnel had had. The results are shown in table 2. It can be seen that the training program leaves many segments uncovered. A great number of ships making reports, however, contemplated following some sort of training program for the ensuing year, such as the use of films, lectures, posters, on-the-job training, et cetera. It is hoped that these programs will be adhered to and that when

the figures for 1951 are available a great increase in the percent of trained personnel will be noted.

TABLE 2. *Review of supervision and training of mess personnel*

Supervision and training reported	*Fleet (percent)*	*MSTS (percent)*
Officers supervising food-handling operations	96.3	70.9
Senior petty officers supervising food handlers	97.1	50.9
Mess hall Master-at-arms (nongalley rates) supervising food handlers at sculleries, et cetera	82.7	27.3
Civilian managers supervising food handlers	Not applicable	69.1
Ships' company military food handlers regularly assigned who had food-handling course during year	26.5	7.2
Civilian food handlers who had food-handling training during year	Not applicable	41.8
Temporary or part-time food handlers receiving some sort of instruction in preparation for duties	30.5	30.9
Food handlers' training courses contemplated for year	87.6	Not applicable; food handlers are hired as "qualified"
Basic training courses available on board	19.1	3.6
Basic courses available off station	13.9	21.8
Refresher courses available on board	8.6	5.5
Refresher courses available off station	2.3	Not applicable
Personnel aboard who completed a food-handlers' course for supervision	34.9	43.6
Supervisors serving as instructors of food handlers	31.2	21.8
Instructors on board who had training as instructors	24.4	27.3

There are far too many snips with untrained personnel aboard. True, a large number of reporting ships had officers supervising food-handling operations, but when the analysis was made of those under them with training in the routines, only about one-fourth were able to report trained personnel aboard. We should not be led into a false sense of security when we read the figures on officers and chief petty officers supervising the handling of food, et cetera. The fact that a man

has advanced to one of these positions through service and hard work in some unrelated field does not necessarily mean that he is qualified to supervise the handling of galley personnel, if he has had no training for that particular job. On the other hand, if these officers are in the medical department, it is assumed that they are familiar enough with general sanitation to be able to supervise food-handling operations with a minimum of formal training. To be on the safe side, however, all persons connected with food and eating utensils in any way should be subjected to training of some type at the earliest convenient date, and this training should be reviewed periodically and reinforced if necessary.

As for the part of the program under the direction of the Preventive Medicine Division, Bureau of Medicine and Surgery, many improvements have been made in the past few years through liaison and numerous conferences with other Bureaus and offices.

Many interesting facts have been gathered from research into machine design, formulation of better dishwashing detergents, and maintaining proper detergent concentrations by automatic detergent dosing devices and concentration meters. Specifications that were considered interim in 1950 have now become permanent with respect to design of equipment for use at various shore installations and on board ships. Detergent waste has been drastically reduced with the advent of 2-pound packages to supplement the barrels which formerly comprised the only available packages. Detergent-addition and metering devices have undergone extensive review and a few are being purchased for study with the ultimate goal of having them installed on all automatic equipment for dishwashing. Further, the Navy has been seeking better formulas for a new detergent for use on ships where space limitations dictate that dishes and eating equipment be washed by hand, with a view to eliminating the old harsh soaps used in the past. Machine-dishwashing detergents have been made available to fit the variations in hardness of the water found in different localities.

A new manual for standard methods to be followed in scullery and galley sanitation with respect to training dishwashing-machine operators and supervisory personnel is now being compiled by the Bureaus of Medicine and Surgery, Ships, Yards and Docks, and Supplies and Accounts. In conjunction with introducing the new manual "Instructors' Guide, Sanitary Food Service," which demonstrates a new trend in educational technics, a tour is being made by representatives of the Bureau of Medicine and Surgery, the Bureau of Supplies and Accounts, the Air Force, and the Public Health Service to bring outlying districts up to date on the newest and most effective methods of food handling and the problems connected with it. Finally, but by no means least important, the Navy has established a research project for the study and evaluation of the design of mechanical dishwashing equipment, detergents, detergent-addition meters, et cetera, in order to keep it up to

date on the latest developments that occur as a result of civilian or naval industrial research.

The outlook for the future is bright. Supervisors, particularly the reporting representatives of the various ships, seem to be well aware of discrepancies in training and in existing conditions and are conscientiously making every effort possible to correct these deficiencies. Fleet Commands have made food-handlers' training mandatory. An increased effort is being made to keep conditions up to standard for messing facilities and sculleries. The job must be continued and constantly emphasized. The training of artificers in the maintenance of dishwashing machines has been recommended, and will eventually lessen the burden on the inspecting officers and medical department representatives. This will also insure adequate functioning of equipment in galleys, sculleries, and mess halls at all times for they will be under the constant surveillance of trained personnel who will be thoroughly familiar with their jobs and who will know how to correct discrepancies when they arise, or will realize the importance of reporting such matters to the proper authorities.

With continuing co-operation between the men at sea, at shore installations, and conducting research into various facets of the problems, the matter of sanitation with respect to messing facilities can be brought to a much higher level and the possibility of disease transmission caused by temporary breakdowns in the program can be brought to a point of almost negligible concern. This problem is far from hopeless. Great advances are being made and will continue to be made which will ultimately result in less work for all concerned and a safer and more pleasing mealtime regimen.

BOOK REVIEWS

Collected Papers of the Mayo Clinic and the Mayo Foundation, edited by *Richard M. Hewitt,* B. A., M. A., M. D.; *A. B. Nevling,* M. D.; *John R. Miner,* B. A., Sc. D.; *James R. Eckman,* A. B., M. A., Ph. D.; *M. Katherine Smith,* B. A.; *Carl M. Gambill,* A. B., M. D., M. P. H.; and *Florence Schmidt,* B. S. E. Vol. XLIII, 1951. 833 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., 1952.

Of the 604 articles from the Mayo Clinic and Mayo Foundation published in various journals between 1 December 1950 and 1 December 1951, 412 are listed by title only. The 192 presented in full, abridged, or in abstract form in this volume are brief, succinct, and readable. They are arranged by the organ system to which they apply rather than by the medical specialty classification of the authors. There are many ex-

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cellent illustrations. Although all of the material has been published elsewhere, few libraries will contain all of the journals here represented. Some of the articles are general reviews and are not detailed because of space limitations. Many articles report a sizeable experience with rare or unusual diseases. Extensive clinical material and the excellent record and follow-up systems which make this type of reporting possible are indeed impressive. There is something of interest to everyone and the titles range from "Abdominal Masses" to "You, too, Can Draw." The diversity of subject matter and viewpoint will serve to bring the reader up to date in many aspects of medicine outside of special interest. This book is recommended as an annual "refresher course" for all physicians interested in general medicine and surgery.—*Lt. Col. B. H. Sullivan, Jr., MC, U. S. A.*

Basic Principles of Cancer Practice, A Book on Diagnosis, Prognosis, and Treatment of Human Neoplasms for the General Practitioner and Medical Student, by *Anderson Nettleship,* M. D., F. A. C. P., Fellow, New York Academy of Medicine; Professor of Pathology, University of Arkansas School of Medicine; Pathologist-in-Chief, University Hospitals, Little Rock. 398 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1952. Price $7.

The author's aim to present a brief, up-to-date, clinical and pathologic review of cancer in a form useful to the general practitioner is adequately accomplished. This book is well illustrated, and consists of 9 chapters on the general aspects of cancer and 10 chapters describing the principal tumors arranged by anatomic systems. Each chapter contains a selected bibliography. The book is not exhaustive, but anyone wishing a good general review of the subject will find it useful. The author points out the great need for expert diagnosis and treatment of the cancer patient and believes that this can best be accomplished by proper teamwork in a well-staffed oncologic center that offers its services to all sufferers from cancer. He also stresses other serious inadequacies in the attack on cancer, such as the time lags, both before the diagnosis is established and before adequate treatment is instituted. The practitioner must necessarily assume a large share of the effort to overcome these deficiencies, and this book will help him. Availability to the practitioner of the various experts necessary for proper diagnosis and adequate treatment is essential. The author states, "The high incidence of resectable gastric cancer has never been realized by the practitioner. Until recently only 14,000 gastrectomies were recorded in the world's literature, whereas there are probably almost this number which could be performed in the United States each year. He believes that the most abysmal ignorance and the best diagnostic and treatment teamwork exist side by side in this country.

—*Col. R. P. Johnson, MC, U. S. A.*

ACUTE HEMOLYTIC ANEMIA WITH INFECTIOUS MONONUCLEOSIS[1]

ALAN C. MERMANN, *Lieutenant, junior grade, MC, U. S. N. R.*

ANEMIA occurs so infrequently in patients with infectious mononucleosis that the presence of normal erythrocytes is considered a diagnostic feature of the disease. Wintrobe *(2)* stated that "the finding of anemia makes the diagnosis of infectious mononucleosis highly improbable." Cecil *(3)* observed that the red blood cells, hemoglobin, and platelets are normal in infectious mononucleosis.

Within the past few years, however, reports of a few patients with acute hemolytic anemia associated with infectious mononucleosis have appeared in the medical literature. Custer *(4)* mentioned studying 2 patients and Sawitsky et al. *(5)* have reviewed the literature and added a patient in whom autosensitization of the red blood cells was demonstrated by the use of the Coombs' reagent during the hemolytic phase of the disease. The purpose of this article is the brief presentation of another case of infectious mononucleosis complicated by the development of acute hemolytic anemia.

CASE REPORT

A 19-year-old man was admitted to a naval hospital on 27 February 1952. On 5 February he had noted the onset of a common cold with rhinorrhea and an occasional cough, but no fever. He treated himself with an antihistaminic drug, taking 6 tablets in 48 hours without relief

(1) From the U. S. Naval Hospital, Yokosuka, Japan.

(2) Wintrobe, M. M.: Clinical Hematology. 2d edition. Lea & Febiger, Philadelphia, Pa., 1946. p. 806.

(3) Cecil, R. L. (editor): A Textbook of Medicine. 7th edition. W. B. Saunders Co., Philadelphia, Pa., 1947. p. 517.

(4) Custer, R. P.: An Atlas of the Blood and Bone Marrow. W. B. Saunders Co., Philadelphia, Pa., 1949. pp. 207-208.

(5) Sawitsky, A.; Pappa, J. P.; and Wiener, L. M.: Demonstration of antibody in acute hemolytic anemia complicating infectious mononucleosis. Am. J. Med. 8: 260-262, Feb. 1950.

of symptoms. A few days later he reported to sick call in a forward area and was given APC tablets. The symptoms of an upper respiratory infection persisted and on 20 February he was admitted to the sick bay complaining of headache and loss of appetite. His spleen was enlarged and tender. The erythrocyte count was 3,500,000 and the leukocyte count was 12,800 with 76 percent lymphocytes. Icterus and splenomegaly were first noted on 22 February. The patient received penicillin intramuscularly twice a day for 2 days. On 23 February the leukocyte count was 34,000 and bile and albumin were found in the urine.

On 25 February the patient was transferred to a hospital ship where his general condition was described as poor, with notable pallor and icterus. A temperature of 105.4° F. and a blood pressure of 140/60 were recorded. Examination disclosed enlarged and tender cervical and axillary lymph nodes. The spleen was markedly enlarged and tender, but the liver was not palpable. A soft systolic murmur was heard. The hemoglobin concentration was 25 percent, the erythrocyte count was 1,420,000 and the leukocyte count was 31,680 with 80 percent lymphocytes. The patient was given one injection of penicillin and 500 cc. of whole blood. On the following day the hemoglobin was 43 percent, and 1,000 cc. of whole blood was given.

The patient was transferred to a naval hospital on 27 February with a diagnosis of infectious mononucleosis. At that time he appeared well-developed and well-nourished, but acutely ill. His temperature was 100° F., pulse 104, and blood pressure 120/60. There was severe pallor and icterus of the skin, scleras, and oral mucosa. Palpable lymph nodes from 1 to 1.5 cm. in diameter were observed in the cervical, supraclavicular, axillary, epitrochlear, and inguinal areas. The spleen was palpated 2 cm. below the left costal margin and the liver was felt at the right costal margin and noted to be tender.

The laboratory findings on admission were hemoglobin 6 gm., erythrocyte count 1,890,000, hematocrit 21 mm., and leukocyte count 26,500 with 63 percent lymphocytes, of which the predominant form was the atypical lymphocyte characteristic of infectious mononucleosis (6). Twenty-eight nucleated red blood cells per 100 leukocytes were seen and the reticulocyte count was 8 percent. Bone marrow aspiration revealed normal myelopoiesis and increased erythropoiesis. The titer of heterophil agglutinins was 1:1,792 and the titer of cold hemagglutinins was 1:128. The icterus index was 14 and the indirect van den Berg reaction was 0.6 mg. per 100 cc. Blood cultures were sterile (including culture for *Leptospira icterobaemorrhagiae*).

The temperature of the patient remained between 99° and 100° F. during the first week of hospitalization and was normal thereafter. He was given 850 cc. of whole blood during the first 48 hours in the hospital and his hemoglobin was 7.7 grams at the conclusion of the trans-

(6) See footnote reference (2), p. 805.

fusion. He was given no antibiotic therapy, but did receive 0.6 gram of ferrous sulfate twice a day for 2 weeks.

By 3 March the leukocyte count had fallen to 8,400 with 40 percent lymphocytes. Microscopic examination of an excised posterior cervical lymph node was consistent with the diagnosis of infectious mononucleosis. By 4 March the icterus was noticeably fading and the spleen was smaller. The patient's appetite improved and he requested ambulation. On 10 March the spleen was no longer palpable and the generalized lymphadenopathy had diminished markedly. The titer of heterophil agglutinins on this date remained at 1:1,792 and the titer of cold hemagglutinins had risen to 1:2,048. The hemoglobin was 9 grams and the leukocyte count was 6,650 with 50 percent lymphocytes. On 19 March the titer of heterophil agglutinins was 1:996 and the titer of cold hemagglutinins had fallen to 1:128. The patient was on full ward activity and physical examination was normal.

On 28 March, 1 month after admission, the hemoglobin was 13 grams, the hematocrit 44 mm., the leukocyte count 5,900 with 54 percent lymphocytes, the titer of heterophil agglutinins 1:448 and the titer of cold hemagglutinins was 1:32. The patient was discharged to full duty.

SUMMARY

In a 19-year-old man with infectious mononucleosis complicated by acute hemolytic anemia, an initial high titer of heterophil agglutinins, a rising titer of cold hemagglutinins, and a subsequent fall of both antibodies were demonstrated. Recovery was uneventful after the anemia was corrected to 7.7 grams of hemoglobin by whole blood transfusions.

BOOK REVIEWS

Annual Reprint of the Reports of the Council on Pharmacy and Chemistry of the American Medical Association, With the comments that have appeared in the Journal of the American Medical Association, 1951. 165 pages; illustrated. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1951.

Although most of the information contained in the volume has been published in the Journal of the American Medical Association, it is a timesaving publication. Outstanding reports in the volume are: (1) The Status of Blood "Substitutes," (2) Current Status of Hormone Therapy in Advanced Mammary Cancer, (3) A Status Report of "Krebiozen," (4) Narcotics in Pre-anesthetic

Medication, (5) Radioactive Isotopes in the Medical Research, and (6) Diagnosis and Therapy and Chemotherapy of Tuberculosis in Man. Each of these reports contains a tremendous amount of concise and exact information. This book should be present in each of the Armed Forces hospital medical libraries, but I do not believe that it would be of great value to the average practitioner of medicine.—*Lt. Col. J. R. Vivas, MC, U. S. A.*

Symposium on Radiobiology, The Basic Aspects of Radiation Effects on Living Systems, Oberlin College, June 14-18, 1950. Edited by *James J. Nickson.* Editorial Committee: *P. Morrison, E. S. Guzman Barron, H. M. Patt, M. Burton, G. Failla.* Sponsored by *The National Research Council of the National Academy of Sciences.* 465 pages; illustrated. John Wiley & Sons, Inc., New York, N. Y., publisher, 1952.

The 26 participants in this symposium were from various countries and represented numerous disciplines. All approached this frightfully complex biologic field with the general concept of constructing working models of the effects of radiation on relatively simple systems, thereby hoping to pave the way for fruitful research by the biologists. I cannot intelligently comment on all phases of the symposium. Although the average physician will find himself lost in an unfamiliar mathematical morass in some of the sections on the physical and chemical effects of radiation, all of the sections are summarized adequately so that the mathematically uninitiated can grasp the general concept. In addition to the physical and chemical effects of radiation, excellent sections are presented on the mechanism of the action of radiation on cells and the production of mutations. The target theory, multiple hit theory, theory of chemical effects of radiation by free radical formation, and a diffusion cell theory which combines all factors previously considered important are presented.

The general tenor of the symposium is on the effects at a chemical, subcellular, and cellular level. Little space is devoted to discussion of the radiation syndrome in mammals as a function of dose and time after radiation. The gap between the initial effects on the cell and the final syndrome in mammals is great and is not bridged. The scant coverage of the mammalian radiation syndrome will be disappointing to physicians. Each section is scholarly and well illustrated. References are ample. The most serious fault of this book is that it is published 2 years after the symposium and fails to take into account much progress that has been made in the intervening period.

—*Commander E. P. Cronkite, MC, U. S. N.*

MANIFESTATIONS OF DEPENDENCY ATTITUDES IN NAVAL OFFICERS

JOHN W. THOMAS, *Commander, MC, U. S. N. (1)*

THE problem of dependency as a manifestation of emotional immaturity is sometimes met with in officer patients. Such officers are completely unable to acknowledge or recognize their infantile needs (2, 3). By and large, they have advanced steadily through the years earning promotions through diligence and unusual devotion to the naval service. A time comes when they no longer function efficiently and must be hospitalized. An impression exists that those officers who apparently entered the Navy primarily for neurotic reasons frequently exhibit conflicts over dependency problems. They have come to look on the Navy as their home or, as they frequently say, even as a family. They complain that the Navy has changed (4-6).

In their complaints is the implication that valued customs and old relationships have disappeared and have been replaced by antagonizing systems of discipline and personal behavior. They miss the emphasis on "battleship standards" of dress, respect, and predictable living. They complain that the present need for flexibility in adjustment to new situations and technical advances puts a premium on initiative and education they have been denied through force of circumstances. The reactions of this group of officers cannot entirely be laid to lack of resiliency due to fixation of habit and personality patterns in consequence of the aging process. Many of them are relatively young in

(1) U. S. Naval Hospital, Oakland, Calif., at time of writing; now at Tripler Army Hospital, Honolulu, T. H.

(2) Kubie, L. S.: Neurotic potential, neurotic process, and neurotic state. U. S. Armed Forces M. J. 2: 1-12, Jan. 1951.

(3) Saul, L. J.: Emotional Maturity: The Development and Dynamics of Personality. J. B. Lippincott Co., Philadelphia, Pa., 1947. pp. 8, 84, 163.

(4) Greenhill, M. H., and Löwenbach, H.: Neuropsychiatric rehabilitation problems of discharged veterans in rural communities of the South. In Association for Research in Nervous and Mental Disease: Military Neuropsychiatry. Proceedings of the Association, Dec. 15 and 16, 1944, New York, N. Y. Research Publications, Association for Research in Nervous and Mental Disease, Volume 25. Williams & Wilkins Co., Baltimore, Md., 1946. chap. 32, p. 330.

(5) Grinker, R. R.: Dynamic study of war neuroses in flyers returned to United States. In Association for Research in Nervous and Mental Disease: Military Neuropsychiatry. Proceedings of the Association, Dec. 15 and 16, 1944, New York, N. Y. Research Publications, Association for Research in Nervous and Mental Disease, Volume 25. Williams & Wilkins Co., Baltimore, Md., 1946. chap. 3, p. 31.

(6) Lemkau, P. V.: Mental Hygiene in Public Health. McGraw-Hill Book Co., Inc., New York, N. Y., 1949. pp. 203 and 226.

years, although old in length of service. Precipitating situations are evident. These set in motion old behavior patterns in which poorly integrated or incompletely gratified dependency needs are apparent.

Presenting symptoms are frequently somatic in terms of pain or malfunction of stomach or bowel (7-9). Headache, backache, and tension symptoms from the circulatory system are related to autonomic system imbalance and usually initiate admission to the sick list. Marital difficulties, reflected in disturbed sexual adjustment, are common. Distressingly frequent is their resort to the excessive use of alcohol (10). This adds additional stress in terms of retaliation by an authoritarian military environment. Social drinking is accepted, but it is expected that an officer will exercise proper judgment and adequate control. These officers complain that their efforts are no longer appreciated nor their presence wanted, and that they are subjects of discrimination in matters of promotion and social acceptance. Examination of their relationships with others indicates marked ambivalence toward authority (11). The prospect of financial security and retirement, which once was so attractive, does not now suffice; neither are family relationships satisfying nor sufficiently rewarding. A pervasive feeling of futility and rejection overwhelms previously adequate warding-off mechanisms, such as meticulous and conscientious performance of duty and loyalty to the department, the ship, or the Navy. They say the Navy has changed, the ship is too large, and the division too complicated with its shifting personnel and technical detail. Now they can no longer find adequate support and identification with a suitable small group. This lack is painfully apparent in their search for reassurance and understanding which usually begins or ends with their seeking relief from somatic symptoms. It is in such a setting that a precipitating situation occurs. Old defenses against anxiety usually fail in some crucial relationship with an authoritarian figure (12).

Modification of the immediate environment or assignment to limited duty provides insufficient or no relief. Psychotherapeutic efforts on a short-term basis are also disappointing in terms of establishing former useful self-assertiveness and efficiency. A modified psychotherapeutic approach may be applicable in certain cases. A recognition of the factors in the individual officer, which made possible an acceptable level of adjustment prior to hospitalization, may be fruitful in terms of renewed self-esteem.

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(7) See footnote reference (4). p. 28.

(8) Weiss, E., and English, O. S.: Psychosomatic Medicine. 2d edition. W. B. Saunders Co., Philadelphia, Pa., 1949. pp. 488-499.

(9) Alexander, F. (Chicago): Treatment of case of peptic ulcer and personality disorder. Psychosom. Med. 9: 320-330, Sept.-Oct. 1947.

(10) Lorand, S.: Technique of Psychoanalytic Therapy. International Universities Press, Inc., New York, N. Y., 1946. p. 141.

(11) Bergler, E.: Three tributaries to development of ambivalence. Psychoanalyt. Quart. 17: 173-181, Apr. 1948.

(12) Sperling, M.: Psychoanalytic aspects of bureaucracy. Psychoanalyt. Quart. 19: 88-89, 1950.

CASE REPORTS

Case 1. A 37-year-old, married lieutenant with 20 years of service was hospitalized because of increased irritability, tension, insomnia, anorexia, epigastric pain, diarrhea, and constant preoccupation with intense resentment of his superior officers. Their alleged corruption, inefficiency, and social and professional conduct, he felt, was a disgrace to the Navy and prejudicial to the nation's interest as an occupying power. He claimed that ambition and conscientiousness had carried him up through the ranks to positions of importance with which his present rank was not commensurate and complained that the "old battleship Navy" with its polish, respect, and discipline was gone. He was reared on a poor Nebraska farm. He could not remember how his mother looked or how he felt about her. He stated that his stepmother beat his younger brother until he was unconscious and failed to get medical aid before he died. She burned another brother with a soldering iron and broke his finger. His father was absent from the home for months at a time, supplementing the family income as a salesman, and gave the patient no protection. As a child of 12 years he went to the county judge to ask for help, but was told to go home and obey his parents. He resented the minister who came to the home to pray with his stepmother that the children would be good. He ran away and joined the Navy.

He took special pride in his meticulous performance of all of his duties. Recently, work had given less satisfaction, and he found little emotional support from his wife. He came to hate his superiors and what he believed was their contempt for his striving. He developed headaches and diarrhea. Hospitalization provided only minimal improvement and retirement was indicated.

Case 2. A 36-year-old, married warrant officer with 17 years of service was admitted because of stuttering, amnesia, and excessive use of alcohol. He was constantly preoccupied with the alleged refusal of the Navy to permit him to revert to the rate of chief petty officer to enable him to receive extra pay and allowances totaling more than he received as a warrant officer. He resented his superiors and accused them of holding up a promotion because it was expedient to keep him on the ship. His wife nagged him about having to cook on a 2-burner, housing-project stove and about his inability to demand or purchase something better. His father had been moody and had killed a man in "self-defense." The father drank and later committed suicide. The patient had been placed in various orphanages by his mother. He claimed he always felt unloved and unwanted. He was released to enter the Navy. He married a woman he found in a bar because he felt sorry for her, saying, "She looked beaten down like a wet pup. She was a runaway like me." His wife often struck him and chased him out of the house. He complained the Navy had changed and felt that he was no longer appreciated. His stuttering, tension, and amnesia cleared with

hospitalization, but he was considered too passive, clinging, and indecisive to return to duty.

Case 3. A 29-year-old, married lieutenant with 13 years of service was admitted complaining of bandlike headaches and abdominal cramps. He gave a history of bitter conflict with his commanding officer and persistent suspicion of his wife's fidelity. He was beaten as a child by his alcoholic father. The family moved from town to town and he felt friendless and inferior in school. His mother was solicitous but bossy and demanding of attention. He was jealous of his older brother who was preferred and had economic advantages denied the patient. He entered the Navy very young and seldom visited home. His father died suddenly in 1948. He reacted to his father's death with anxiety and depression of such intensity that he sought psychiatric help. He improved and was assigned as executive officer aboard a small combat vessel where he was in close daily contact with a very exacting and severe commanding officer. His symptoms began after his wife and the commanding officer's wife drove across country together. He soon found himself in conflict with his superior and felt his wife gave him no support. A review of his relationship with his parents, particularly his father, and other significant persons in his life, was attempted. Feelings of guilt and anxiety and compulsive resort to defensive-aggressive attitudes became less necessary. There was gradual relief of symptoms and he returned to duty.

Case 4. A 34-year-old lieutenant was admitted because of headache, cardiac palpitation, fear of failure in his duty assignments, and preoccupation with any criticism, actual or implied, by his superiors. His cardiac complaint was readily recognized as an anxiety symptom and he was transferred to the psychiatric service. He blamed his recently divorced wife for the failure of their marriage, and for his fears, because of her unwillingness to follow him in the Navy. He felt guilty and depressed. He was overly polite, obsequious, and self-depreciating with fellow officers. He was the third of 6 children in a family of Greek extraction, born and reared in Louisiana. He spent most of his childhood in parochial boarding schools. He lost his mother at the age of 6 years. He had little to do with his father and was earning his own living at 13, enlisting in the Navy at 17 years of age. He was hardworking, serious, and conscientious and was made a temporary officer in 1942. He made frequent requests in the 2 years prior to admission to be returned to his permanent enlisted rank. He felt himself to be lacking in education and assurance for officer rank, but admitted he was better versed than younger contemporaries in the knowledge of his duties. He was upset and personalized any question related to his work, construing it as destructive criticism. He was dependent, passive, covertly hostile, and exhibited marked vasomotor lability. His acceptance of any interpretation of his reaction in terms of personality attitudes remained tentative. He said in effect, "Nothing

I can do will please them, so let them take care of me as they did in the past." It was considered unlikely that he could adjust for further useful service.

SUMMARY

The successful struggle with dependency and passivity feelings is a continuous process in a person's emotional growth. In the patients here described the dependency needs were, in most instances, denied and somatic symptoms provided the basis for admission to the sick list. A developmental setting, devoid of normal affection and the absence of suitable parent figures or substitutes, is responsible for tentative or poorly integrated identifications in these patients. Repeated conditioning experiences in early life may make these officers peculiarly susceptible to ultimate breakdown and reversion to infantile reaction patterns within a necessarily authoritarian framework, such as the Navy. This represents a certain irony of fate. These patients' choice of a career is neurotic in that it represents a search for security, a home, or a protective parent in the form of this same military organization. Appreciation of these factors may have implication for officer procurement and selection.

BOOK REVIEWS

The Knee and Related Structures, Injuries, Deformities, Diseases, Disabilities, by *Philip Lewin,* M. D., F. A. C. S., F. I .C. S., Professor and Chairman of Department of Bone and Joint Surgery, Northwestern University Medical School; Attending Orthopedic Surgeon, Cook County Hospital; Senior Attending Orthopedic Surgeon, Michael Reese Hospital; Professor of Orthopedic Surgery, Cook County Graduate School of Medicine, Chicago; Formerly Colonel, Medical Corps, A. U. S. 914 pages; illustrated. Lea & Febiger, Philadelphia, Pa., publishers, 1952. Price $16.

In 44 chapters, plus an appendix, the author has exhaustively presented the various injuries, deformities, diseases, and disabilities of the knee and related structures. The co-ordination and integration of such a mass of information concerning the causes, diagnosis, treatment, and prevention of all of the affections of this major joint, hitherto only available in numerous texts and various articles in periodicals, has been completely successful. The pros and cons of various therapies of the many controversial issues regarding the lesions of the knee are impartially presented in concise form. Dr. Lewin's ready access to all the domestic and foreign literature has made it possible for him to include an exhaustive and authoritative bibliography.

—*Lt. Col. V. B. Vare, Jr., MC, U. S. A.*

Internal Medicine, Its Theory and Practice, originally edited by *John H. Musser*, B. S., M. D., F. A. C. P., Late Professor of Medicine in the Tulane University of Louisiana, School of Medicine, New Orleans, La. 5th edition edited by *Michael G. Wohl*, M. D., F. A. C. P., Associate Professor of Medicine, Temple University School of Medicine; Chief of Nutrition Clinic, Philadelphia General Hospital; Chief of Endocrine Clinic, Temple University Hospital, with *80 contributors*. 1,563 pages; 236 illustrations; 10 color plates. Lea & Febiger, Philadelphia, Pa., publishers, 1951. Price $15.

This edition of an old classic is new from cover to cover. There are 80 contributors who are prominent in their respective fields. Cross-referencing between authors is carried to an amazing degree and the index is lengthy and detailed. Each disease described in this book provides the reader with a review of the recent literature on the subject. Physiology and pathology are emphasized throughout and lengthy discourses relative to controversial theories as to etiologies are conspicuously absent. The outstanding sections are those on infectious diseases, endocrinology, renal diseases, and the care of the aged. As an illustration of the many special subjects covered, the section on heart disease and pregnancy provides a ready reference for the obstetrician, internist, and general practitioner. Paradoxically, this book seems well suited to medical students and internists alike. It seems particularly suited for those studying for the Board of Internal Medicine. With the publication of this book a new high has been achieved in the detailed coverage of the field of internal medicine.

—*Commander F. T. Norris, MC, U. S. N.*

Blood Transfusion in Clinical Medicine, by *P. L. Mollison*, M. D., M. R. C. P., M. R. C. S., Director, Medical Research Council's Blood Transfusion Research Unit, Lecturer in the Department of Medicine, Post-graduate Medical School of London, with a foreword by *Sir Alan N. Drury*, C. B. E., F. R. S. 456 pages; illustrated. Charles C Thomas, Publisher. Springfield, Ill., 1951. Price $8.

The knowledge on blood transfusions, which has come to light in the past 12 years, is clearly and concisely compiled in this book. The author has included much of his own research, especially that related to the methods of blood preservation and its effect on the survival of the transfused cells. He quotes over 500 references in the American and British literature. The blood group factors are exceptionally well described and the fact that so many are so weakly antigenic is stressed. The regulation of blood volume by transfusion and the effects of transfusion on the circulation are given deserved emphasis. The unfavorable effects, such as incompatibility, hemolytic reactions, air embolism, transmission of disease, exogenous hemochromatosis and iso-immunization, are well covered. Unfortunately, the uses of positive pressure transfusions and intra-arterial transfusions are not mentioned.

—*Commander L. J. Pope, MC, U. S. N.*

LIDOCAINE

A New Local Anesthetic

PHILIP A. COX, *Major, U. S. A. F. (MC)* (1)

DANIEL J. ABRAMSON, *M. D.* (2)

LIDOCAINE (diethylamino-2, 6-acetoxylidide) was synthesized by Löfgren in 1943 (3). He stated that lidocaine is more stable than other local anesthetics. Boiling for 8 hours in 30 percent hydrochloric acid does not cause it to decompose. According to Gordh (4), its action on motor nerves is 3 times as great as that of procaine. His experiments demonstrated that 0.25 percent lidocaine solution corresponded in duration to a 2 percent procaine solution. With the addition of 1:100,000 epinephrine to 1 percent lidocaine, the wheal duration was from 4 to 5 hours, whereas 1 percent procaine had a duration of from 60 to 90 minutes. The rate of onset of anesthesia was about twice as fast with lidocaine as it was with procaine.

Lidocaine is not irritating to tissues even in concentrations as high as 8 percent (4) and cocaine is 5 times more toxic (3). The absolute toxicity of lidocaine is somewhat greater than that of procaine (3), but its relative toxicity, i.e., the higher anesthetic efficiency of lidocaine in comparison with procaine, is lower. The recommended total dose of from 0.5 to 1 gram is the same as for procaine (4). Lidocaine produces very few reactions. Toxic reactions, particularly from overdosage, occasionally occur. There may be irritation of the central nervous system accompanied by respiratory and circulatory collapse. The mild reactions are characterized by dizziness, faintness, nausea, and vomiting, and the severe reactions by unconsciousness and convulsions. Treatment of these reactions consists of the establishment of a free airway, administration of oxygen, artificial respiration, and lowering of the head. When convulsions occur, they should be treated with the intravenous administration of a short-acting barbiturate.

Haines and Grabstald (5) had no untoward reactions in a series of 250 transurethral procedures in which 2 percent lidocaine was used. Dabbs and Southworth (6) employed lidocaine in 132 patients with no

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(2) Surgical Consultant, Walter Reed Army Hospital; Surgical Department, Georgetown University School of Medicine.

(3) Löfgren, N.: Studies on local anesthetics. Thesis for Ph. D., University of Stockholm, 1948.

(4) Gordh, T.: Xylocain, a new local analgesic. Anesthesia 4: 4-9, Jan. 1949.

(5) Haines, J. S., and Grabstald, H.: Xylocaine: new topical anesthetic in urology. J. Urol. 62: 901-902, Dec. 1949.

(6) Dabbs, C. H., and Southworth, J. L.: Xylocaine for conduction anesthesia. Anesth. & Analg. 28: 174-176, May-June 1949.

serious toxic manifestations, although 3 had transient muscle tremors and tachycardia but required no treatment. Hanson and Hingson (7) used lidocaine to induce spinal, continuous spinal, peridural, caudal block, saddle block, local block, hypospray, topical, intravenous, and dental anesthesia in over 750 patients. Fewer reactions occurred than with procaine. One death occurred when caudal anesthesia (with 500 mg. of lidocaine) was given to an anuric patient who was in shock from an inadvertent subarachnoid puncture during an attempted epidural anesthesia. Haglund and Conroy (8) reported using lidocaine in various regional procedures (including 50 caudal nerve blocks for anal and vaginal operations) in 100 patients. There were 8 reactions in the caudal block series: 1 hypertensive, due to epinephrine; and 6 mild hypotensive reactions, in 4 patients, due to necessary surgical positioning, and in 2, to a rising level of analgesia. There was also 1 severe hypotensive reaction which responded rapidly to treatment.

CLINICAL STUDY

Lidocaine was used in the outpatient service of this hospital from 13 August 1951 to 20 January 1952 for a variety of minor operations in 300 patients (table 1). No selection of patients was made except that lidocaine was used in 10 patients who stated they were sensitive to procaine. We were first impressed with lidocaine when it was used to replace 2 percent procaine as a field block in the marsupialization procedure for pilonidal cysts and sinuses. Anesthesia with procaine was uniformly unsatisfactory and incomplete, but with lidocaine was almost immediate and lasted throughout the procedure. Where from 30 to 50 cc. of 2 percent procaine was necessary previously, excellent anesthesia was obtained with from 15 to 20 cc. of 1 percent lidocaine. In all of the patients, anesthesia was complete by the time the injection was finished, and there were no anesthetic failures. Some of the procedures lasted as long as 90 minutes and no further anesthetic was needed.

In the 300 cases studied there were 4 reactions. Two female patients complained of mild dizziness and faintness, but were relieved by inhalation of aromatic spirits of ammonia. Both had received lidocaine with epinephrine. A 52-year-old man received about 10 cc. of 2 percent plain lidocaine solution for the excision of a mass in his left breast. About 3 minutes after injection of the drug he became pale, complained of dizziness, and lost consciousness. His blood pressure was 50/0. He was placed in shock position and given epinephrine. Recovery was prompt. The fourth reaction was in a 19-year-old woman who was given about 10 cc. of 2 percent lidocaine with epinephrine for the removal of a fibroadenoma of the breast. About 3 minutes after

(7) Hanson, I. R., and Hingson, R. A.: Use of xylocaine, new local anesthetic, in surgery, obstetrics and therapeutics; preliminary report. Anesth. & Analg. 29: 136-147, May-June 1950.

(8) Haglund, G., and Conroy, W. A.: Xylocaine for regional anesthesia; report on results in caudal block anesthesia. Illinois M. J. 99: 132-134, Mar. 1951.

injection of the solution she felt faint, complained of dizziness, and voided on the table. She recovered promptly with inhalation of aromatic spirits of ammonia. The operation was performed later under local procaine anesthesia with morphine premedication and no untoward reaction was encountered.

TABLE 1. *Summary of operations in which lidocaine was used as the anesthetic.*

Operation	Number
Incision and drainage of abscess	54
Removal of sebaceous cyst	41
Breast biopsy	35
Removal of wart, mole, or nevus	32
Removal of pilonidal cyst	25
Closure of laceration	24
Removal of lipomas or fibromas	15
Removal of external hemorrhoids	13
Low venous ligation	12
Removal of ingrown nail	11
High and low venous ligation	10
Removal of foreign body	7
Removal of external and internal hemorrhoids	4
Removal of rectal polyps	4
Repair of rectal fistula	3
Repair of fissure in ano	3
Removal of ganglion	3
Local blocks	2
Rectal cryptectomy	1
Removal of branchial cleft cyst	1
Total	300

CONCLUSIONS

Lidocaine, a new local anesthetic agent, was used in 300 cases with only 4 reactions. Two of the reactions were mild and the other 2, manifested by hypotension, were moderately severe but promptly responded to treatment. Anesthesia with lidocaine is more prompt, more extensive, and longer lasting than with procaine. Lidocaine is a safe and exceedingly efficient local anesthetic agent.

BOOK REVIEW

A Textbook of Pharmacology, Principles and Application of Pharmacology to the Practice of Medicine, by *William T. Salter,* M. D., Professor of Pharmacology, Yale University School of Medicine. 1,240 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., publisher, 1952.

To those who knew the author before his recent untimely death it is obvious that "This is a personal book, recording the experiences and reflecting the choices of one who has spent many hours at the bedside of clinical patients as well as long nights in the laboratory." Dr. Salter had a unique training for this, his major literary production. His early classical preparation is evident in the scholarly historical presentation in the first chapter and the quotations heading each chapter, ranging from Chaucer's observation on feminism to Thomas Addison's classical description of adrenal insufficiency. The book was written for the medical student and includes many illustrations and viewpoints carried over from his experience as an internist. This is not meant to imply that it is primarily a book on therapeutics; the chemical information and the basic studies on the mode of action and toxicity are presented adequately. The references are well selected. The paragraphs near the end of each chapter on unsolved problems are valuable for the student and stimulating to the investigator.

The descriptions of most of the drugs are logically grouped in appropriate chapters but the tendency to discuss together drugs of diverse structure and toxicity may make it difficult for the student to associate these properties with the drug under discussion. As an instance (p. 54) it is stated that "a particular dangerous untoward response caused by the aniline derivatives is agranulocytic angina," and it is only much further along that it becomes clear that aminopyrine is the only such drug implicated. In addition to the usual presentation of material, there is some recapitulation under a section relating drugs to body systems. This avoids considering many drugs as having but a single therapeutic use and at the same time permits a better presentation of their relative merits.

—Lt. Col. P. K. Smith, U. S. A. F. (MSC)

FRACTURE-DISLOCATION OF HUMERUS DUE TO ELECTROSHOCK THERAPY

ROBERT J. STEINBORG, *Captain, MC, U. S. A. (1)*

FRANK Y. LEAVER, *Colonel, MC, U. S. A. (1)*

ALTHOUGH many fractures secondary to electroshock therapy have been reported, fractures of the humerus are infrequent. Cook *(2)*, in his series of cases, found the frequency of humeral fractures following electroshock therapy to be only 0.24 percent. Most of the fractures that have been reported have involved the surgical or anatomic neck or the shaft. Fractures of the head of the humerus associated with posterior dislocation are quite rare in themselves and following electroshock therapy are still rarer. Recently a patient at this hospital received electroshock therapy during which he sustained a posterior dislocation of the humerus with a compression fracture of the humeral head. This case is presented to call attention to this type of fracture-dislocation as a complication of electroshock therapy.

CASE REPORT

A well-developed 27-year-old Negro was admitted with a diagnosis of schizophrenic reaction, paranoid type. Electroshock therapy was started on 19 November 1951. It was instituted in the usual manner with the patient supine on a hard bench, using firm cushions to support the thoracic spine. One assistant was used to hold each shoulder and hip against the supports. Four treatments were given without complications. After the fifth treatment on 30 November the patient complained of pain in the left shoulder and roentgenograms were taken. They revealed a posterior dislocation and a compression fracture of the head of the humerus (figs. 1 and 2).

DISCUSSION

This case demonstrates an unusual injury secondary to electroshock therapy. The only cases reported in the literature are the 5 observed

(1) Fitzsimons Army Hospital, Denver, Colo.

(2) Cook, L. C.: Recent progress in psychiatry; convulsion therapy. J. Ment. Sc. 90: 435-464, Jan. 1944.

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by Sylwan *(3)*. This seems rather strange as several examples of this injury associated with epileptic convulsions have been cited. Thomas *(4)* reviewed 7 cases with posterior dislocation of the shoulder and found that 4 of these occurred during an epileptic convulsion. Of these, 3 had associated fractures of the humeral head. Sylwan in his series, postulated the injury to be due to spasm of the muscles about the shoulder joint. This is further borne out in Thomas's patients who were

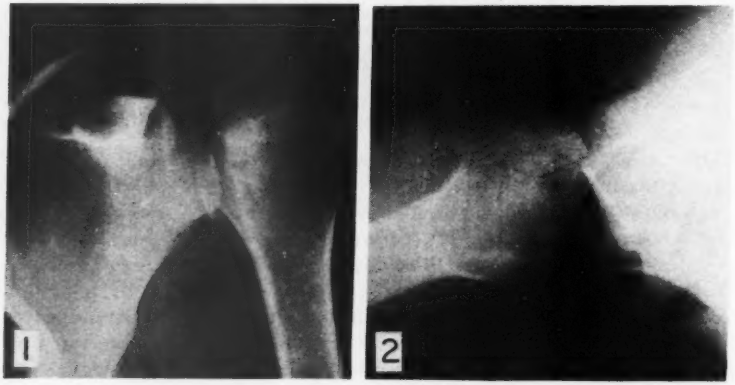

Figure 1. Anteroposterior view of the left shoulder showing a compression fracture of the head of the humerus without visible damage to the glenoid cavity. The dislocation cannot be seen. Figure 2. Vertical view of the left shoulder showing the posterior dislocation of the head of the humerus with the fractured portion of the humeral head overriding the posterior rim of the glenoid cavity.

lying in bed at the time of seizure and persons in attendance denied any external trauma to the shoulder. Sylwan further suggested that the fractures of the head of the humerus were a result of the posterior dislocation of the shoulder in which the head of the humerus was forced against the posterior edge of the glenoid cavity by powerful muscle spasm. He was unable to confirm this, however, as none of his patients presented roentgenographic evidence of dislocation.

Our case substantiates Sylwan's latter suggestion. Roentgenograms of the shoulder showed clearly that the humerus was dislocated posteriorly and the fractured portion was in direct contact with the posterior rim of the glenoid cavity. Apparently the fracture was produced by the medial surface of the head of the humerus being forced against the rim of the glenoid cavity which showed no evidence of damage. No other fractures of the humerus were present. The cause of the dislocation most probably was due to muscular contraction though the possibility of added force supplied by the restraining assistant cannot be eliminated.

(3) Sylwan, T.: Impression fractures in caput humeri in connection with electroshock. Acta radiol. 32: 455-460, 1949.

(4) Thomas, M. A.: Posterior subacromial dislocation of head of humerus. Am. J. Roentgenol. 37: 767-773, June 1937.

REFRACTIVE ERRORS IN ORIENTAL AND CAUCASIAN TRAINEES

MILTON BRAVEMAN, *First Lieutenant, MSC, U. S. A. (1)*

THIS survey is based almost entirely on the eye examinations of trainees at the Hawaiian Infantry Training Center. The relatively high incidence of Oriental trainees compared to that found at other basic training centers afforded the opportunity to compare their eyes with those of Caucasian trainees.

The average age of our patients was 21 years. They were either soldiers with reduced visual acuity in either eye or soldiers with complaints suggestive of ocular disease. A low grade of hyperopia is present in most trainees. These men have little or no visual or ocular difficulties and, hence, their eyes are not examined. The comparison of the eyes of Caucasian and Oriental soldiers which follows should not, therefore, be construed as representative of the general refractive findings of either race, but only as a comparison of the eyes requiring glasses.

In determining the requirements for glasses, SR 40-340-5 was closely adhered to. This special regulation denies (with some exceptions) spectacles to patients with a myopia or an astigmatism of less than 0.5 diopter and to patients with a hyperopia of less than 1 diopter. The records of about 500 patients of each race were used in compiling the statistics. For uniformity, all prescriptions were expressed in plus cylinder form.

It was found that in spheres (fig. 1), the maximum amount of myopia is about the same for the Oriental and the Caucasian, but on the plus end of the graph, the Caucasian eye is much more prevalent, both in the number with hyperopia and in the severity of the error. Aphakic eyes were not used in the computation. Only 0.8 percent of the Orientals, while 12 percent of the Caucasians given spectacles had more than 1 diopter of hyperopia. Of possible interest from a supply standpoint, the middle 75 percent of the graph for the Caucasians extended from plus 1 to minus 3 diopters while the middle 75 percent of that for the Orientals was slightly more concentrated and shifted to myopia of from minus 0.25 to minus 3.75 diopters.

Probably the most significant finding of the survey is the difference in average sphere prescribed; for the Caucasian, minus 0.99; for the Oriental, minus 1.84 diopters. Were the patients drawn from an older

(1) Tripler Army Hospital, Honolulu, T. H.

age bracket, there would be a shift to less myopia. Also, had a general sample been taken instead of just those with visual or ocular difficulties, there would have been a marked shift of the graph to hyperopia.

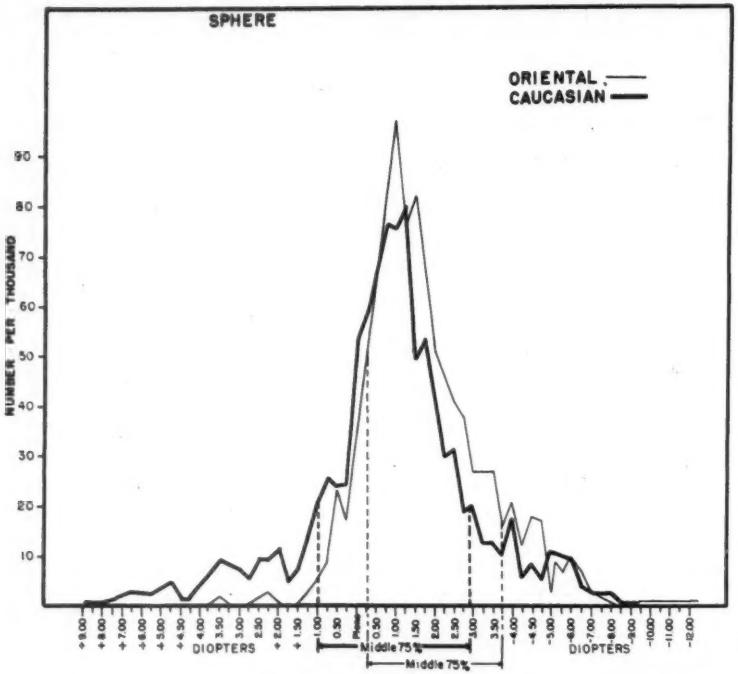

Figure 1. Comparison of spherical correction prescribed for Oriental and Caucasian trainees.

The difference in astigmatic correction was minimal (fig. 2); an average of plus 0.58 and plus 0.67 diopter for the Orientals and the Caucasians respectively. This difference is not sufficient to warrant the assumption that Orientals have less astigmatism than do Caucasians.

Amblyopia was found to be more than 7 times more prevalent among the Caucasians. In the Caucasians amblyopia was due more frequently to an anisometropic hyperopia and in the Orientals it was due more frequently to an anisometropic astigmatism. The Caucasians with amblyopia were predominantly esotropic and in the Orientals exotropia and bilateral fusion were both more common than esotropia.

A greater percent of the Orientals than of the Caucasians had glasses prior to induction. Of the Oriental trainees, 19.7 percent were issued

spectacles and 18.8 percent already had civilian prescriptions. Of the Caucasians, 14.5 percent were given glasses but only 8.6 percent already had civilian prescriptions.

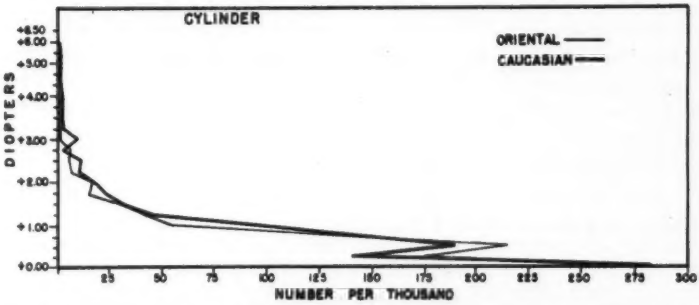

Figure 2. Comparison of cylindrical correction prescribed for Oriental and Caucasian trainees.

CONCLUSIONS

Oriental trainees are less farsighted, more eye-conscious, and less amblyopic than the Caucasian trainees. The first 2 findings, no doubt, account for the third.

BOOK REVIEWS

The Unipolar Electrocardiogram, A Clinical Interpretation, by *Joseph M. Barker,* M. D., F. A. C. P., Cardiologist, Yater Clinic; Associate Professor of Clinical Medicine and Special Lecturer in Physiology, Georgetown University School of Medicine; Director of the Heart Station and Visiting Physician, Georgetown University Hospital; Chief of Cardiology, Providence Hospital; Visiting Physician, Gallinger Municipal Hospital; Consulting Cardiologist, Arlington Hospital, Arlington, Va.; assisted by *Joseph J. Wallace,* M. D., F. A. C. P.; advised by *Wallace M. Yater,* M. D., F. A. C. P. Foreword by *Frank N. Wilson,* M. D., F. A. C. P. 655 pages; illustrated. Appleton-Century-Crofts, Inc., New York, N. Y., publishers, 1952.

This text, although primarily prepared as a guide to unipolar electrocardiography, is a rather complete text on the general subject of clinical electrocardiography. It consists of 18 chapters and an extensive bibliography and index. It is simply written, profusely illustrated and the material well organized. Much space is given to the discussion of cardiac arrhythmias, but nothing new is added. No mention is made of the more recent

and generally accepted unitary theory of supraventricular arrhythmias. The author makes some original observations regarding bundle branch block and right ventricular hypertrophy. The principles and precepts in general are those of Dr. Frank N. Wilson, under whom the author received his training in electrocardiography. This text can be recommended for both the student and the practicing physician. The chapters devoted to the electrocardiographic features of myocardial infarction, ventricular hypertrophy, and conduction disturbances in the ventricles are well prepared and constitute the chief contribution of this excellent text.

—*Col. T. W. Mattingly, MC, U. S. A.*

Physical Medicine in General Practice, edited by *William Bierman,* M. D., Attending Physician, Department of Physical Medicine, Mount Sinai Hospital, New York, N. Y.; Assistant Clinical Professor of Medicine, Columbia University, and *Sidney Licht,* M. D., Lecturer, Physical Medicine, Tufts College Medical College and Boston University School of Medicine; Instructor, Boston School of Occupational Therapy, with 22 contributors. 3d edition. 798 pages; illustrated. Paul B. Hoeber, Inc., New York, N. Y., publisher, 1952. Price $12.50.

This is a comprehensive, up-to-date, and easily understood clinical presentation of a medical specialty and it is of interest to the general practitioner, internist, and surgeon. It is adequately indexed and presents an extensive bibliography. The first 500 pages are devoted to the human body's (1) physiologic response, (2) systemic and local changes, (3) reflex action, (4) vasomotor tone, (5) blood-flow changes, (6) local and systemic pressure changes, (7) metabolic and chemical changes, and (8) therapeutic uses of the various physical modalities. Heat and cold, hydrotherapy, climatotherapy and spa therapy, visible and infrared radiation, diathermy, surgical diathermy, galvanic and low frequency current, ultraviolet radiation, ultrasound, massage, manipulation, functional muscle testing, exercise, occupational therapy, and medical rehabilitation are each discussed separately and in adequate detail.

The rest of the book takes up the clinical application of physical measures in (1) diseases of the locomotor system, (2) arthritis and rheumatic diseases, (3) the lower extremity amputee, (4) neurologic diseases, (5) anterior poliomyelitis, (6) neuromuscular re-education of paralyzed muscles, (7) cardiovascular diseases, (8) diseases of the digestive system, (9) genitourinary diseases, (10) gynecologic diseases, (11) eye, ear, nose, and throat diseases, (12) respiratory diseases, and (13) dermatologic diseases.—*Col. A. E. White, MC, U. S. A.*

SEXUAL PRECOCITY

HARRY J. UMLAUF, Jr., *Major, MC, U. S. A. (1)*

CONN L. MILBURN, Jr., *Colonel, MC, U. S. A. (1)*

THIS report concerns 2 male siblings, ages 1½ and 2½ years, with constitutional precocious sexual development and an extensive family history of the condition. Isolated cases of this type have been reported, but in only 5 previous reports has this disorder appeared to be familial *(2-6)*. (Editor's note: In Pediatrics, Vol. 9, pp. 682-695, June 1952, A. W. Jacobsen and M. T. Macklin, in an article entitled "Hereditary Sexual Precocity," report a family with 27 affected male members.) Most of the case reports *(7-10)* concern female rather than male precocity. Some of our standard texts describe the onset of the precocious sexual characteristics as usually occurring at the age of 5 or 6 years. Both of our patients showed evidence of premature sexual development at the age of 9 months.

CASE REPORTS

Case 1. The younger sibling, an 18-month-old boy (fig. 1), had a normal prenatal and neonatal history. His growth and development appeared normal until he was 9 months old when pubic hair was noted and his genitalia appeared large for his age. At the age of 18 months, when he was admitted to this hospital, his penis was 4 inches long in the flaccid state, his testes were commensurate in size to the penis, and his prostate was readily palpable. He weighed 34 1/4 pounds and was 36 1/4 inches tall.

(1) Letterman Army Hospital, San Francisco, Calif.

(2) Engstrom, W. W., and Munson, P. L.: Precocious sexual and somatic development in boys due to constitutional and endocrine factors. Am. J. Dis. Child. 81: 179-192, Feb. 1951.

(3) Rush, H. P. (Portland, Ore.); Bilderback, J. B.; Slocum, D.; and Rogers, A.: Pubertas praecos (macrogenitosomia). Endocrinology 21: 404-411, May 1937.

(4) Sigrist, E.: Ueber drei Fälle von genuiner und einen Fall von zerebraler Pubertas praecox. Ann. Paediat. 155: 84-106, May 1940.

(5) Orel, H.: Kleine Beiträge zur Verebungswissenschaft. Ztschr. f. d. ges. Anat. 13: (Abt. 2) 13: 691-698, 1928.

(6) Stone, R. K.: Extraordinary precocity in development of male sexual organs and muscular system of child 4 years old. Am. J. M. Sc. 24: 561-564, 1952.

(7) Novak, E.: Constitutional type of female precocious puberty with report of 9 cases. Am. J. Obst. & Gynec. 47: 20-42, Jan. 1944.

(8) Mason, L. W.: Precocious puberty. J. Pediat. 34: 730-740, June 1949.

(9) Lowrey, G. H., and Brown, T. G.: Precocious sexual development; a study of 30 cases. J. Pediat. 38: 325-340, Mar. 1951.

(10) Reubin, M. S., and Manning, G. R.: Precocious puberty. Arch. Pediat. 39: 769-785, Dec. 22, 1922.

His build was stocky and muscular and his size was that of an average boy of about 3 9/12 years. The remainder of the physical (including a neurologic) examination was negative. His 17-ketosteroids level was 1.3 mg. per 24-hour urine specimen. The urine assay for follicle-stimulating hormone (FSH) revealed less than 6 mouse units per 24 hours, and a semen smear was negative for sperms. Roentgenograms of the skull showed extensive

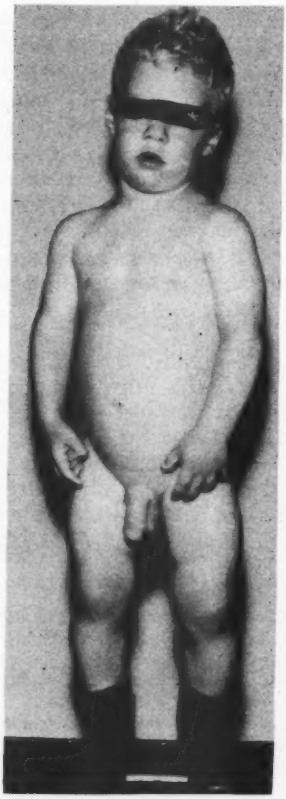

Figure 1.

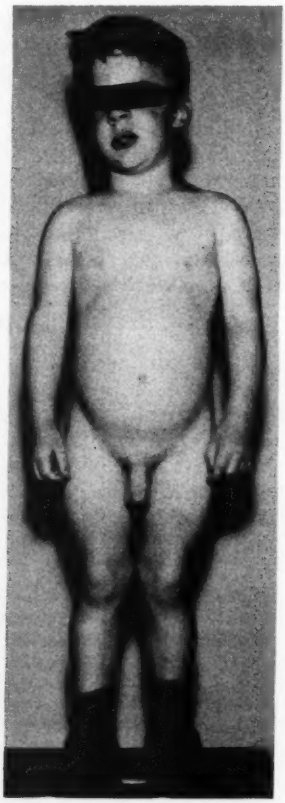

Figure 2.

pneumatization of the mastoid areas bilaterally and, to a lesser degree, pneumatization of the sphenoid sinus. A roentgenogram of the wrists revealed the presence of the triangularis, not normally seen until the fourth year.

Case 2. The older sibling, a 30-month-old boy (fig. 2), had a history similar to that of his younger brother. The prenatal and neonatal courses were normal. His growth and development were

also normal until he was 9 months old when pubic hair was noticed. When he was 12 months old, his mother noted that his penis was extremely large and when he was 30 months old, he had begun to masturbate regularly, had the ability to ejaculate, and exhibited a marked interest in members of the opposite sex.

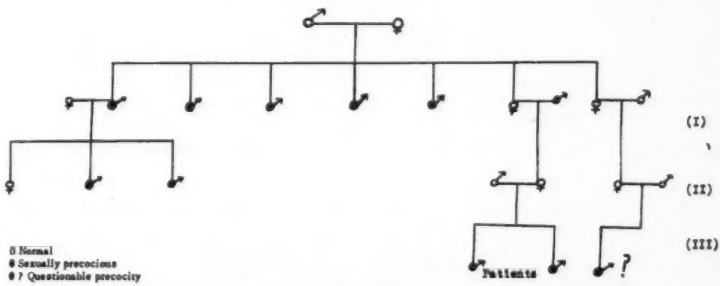

Figure 3. Idiopathic precocious sexual development in male members of three generations.

At that time his height was 42½ inches, and his weight was 44 pounds. He had a stocky and muscular physique and his size was that of an average boy of 5 years. A small amount of black pubic hair was present. His penis was 4 inches long in the flaccid state, his testes were fully developed, and his prostate was easily palpated. The neurologic examination was negative. His 17-ketosteroids level was 2.3 mg. and the FSH assay was less than 6 mouse units per 24-hour urine specimen. Roentgenograms of his skull showed extensive pneumatization of the mastoid area bilaterally, and one of his wrists showed ossification centers for all carpal bones with the exception of the left pisiform. The center for the left distal ulnar epiphysis was also visualized. Roentgenograms of the lower extremities showed epiphyses for the trochanters although those for the lesser trochanters ordinarily do not appear until about the ninth year.

Figure 3 shows the familial tendency to sexual precocity in this family. Two uncles and 5 great uncles had precocious sexual development and 1 first cousin was reported to be quite large for his age, both physically and sexually.

DISCUSSION

These patients were considered unusual because of the early onset of sexual development, and because in only 5 previous reports has this condition appeared to be familial. No treatment is indicated other than the psychologic management of the parents and the boys. The parents were assured that the boys

would become normal adults, although they may be short in stature. They should be treated in such a way as to avoid the development of self-consciousness, or a sense of inferiority or abnormality, and should be protected against the possibility of precocious sexual activity.

Urology Award

The American Urological Association offers an annual award of $1,000 (first prize, $500; second prize, $300; and third prize, $200) for essays on the result of some clinical or laboratory research in urology. Competition shall be limited to urologists who have been in such specific practice for not more than 5 years and to men in training to become urologists. The first prize essay will appear on the program of the forthcoming meeting of the American Urological Association, to be held at the Hotel Jefferson, St. Louis, Mo., 11-14 May 1953. For full particulars write the Executive Secretary, William P. Didusch, 1120 North Charles Street, Baltimore 1, Md. Essays must be in his hands before 15 January 1953.

BOOK REVIEWS

Roentgenology in Obstetrics and Gynecology, by *William Snow,* M. D., Chief Radiologist, Veterans Hospital; Consulting Radiologist, Willis-Knighton Memorial Hospital and Clinic, Shreveport, La.; Formerly Director of Roentgenology, Harlem Hospital, Bronx Hospital, New York, N. Y. 363 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1952. Price $10.50.

This book describes the roentgenologic procedures and the criteria for interpretation of roentgenograms dealing with obstetrical and gynecologic conditions. It is practical, concise, well illustrated, and should be a valuable aid in clinical diagnosis. Much of the material described is based on original analytic studies. The author's contributions are particularly noteworthy in the fields of roentgenographic pelvimetry and in the studies of the placenta and of the pelvic architecture. Throughout, emphasis is placed on roentgenographic diagnosis rather than on technic.

The subject matter includes: roentgenographic pelvimetry, the pelvic architecture, parturition in normal and atypical presentations, the roentgenographic manifestations in the normal development and abnormalities of the fetus, a study of the soft parts in pregnancy, placenta previa, premature placental separation, extra-uterine pregnancy, uterosalpingography, normal and abnormal findings of the genitourinary and gastrointestinal tracts found during pregnancy, pelvic tumors, roentgenographic studies of bleeding in pregnancy and the effect of x-radiation in diagnostic roentgenology.

The chapter devoted to roentgenographic pelvimetry briefly describes the perforated grid methods, the notched centimeter ruler methods, stereoscopic and projection methods and the nomographic method. The author's technic for making corrected pelvimetric measurements is described in detail. The chapters dealing with the pelvic architecture, presentations, position, engagement, and delivery are well illustrated. Hereditary and acquired diseases and deformities of the fetus are briefly described and roentgenographically illustrated. Original roentgenographic studies of the placenta, uterine wall, amniotic fluid, umbilical cord, and vagina are presented. A series of roentgeno-

grams representing extra-uterine pregnancy are included. The technic of uterosalpingography is described and diseases of the uterus and salpinx are roentgenographically illustrated. Intrapelvic and abdominal conditions causing dystocia and diseases of the genitourinary tract are briefly discussed.

This volume should be of value to the radiologist and obstetrician as a quick reference book and should be of practical value to the general practitioner.

—*Col. P. Zanca, MC, U. S. A.*

Ego Development and the Personality Disorders, A Developmental Approach to Psychopathology, by *David P. Ausubel,* M. D., Ph. D., Bureau of Research and Service, College of Education, University of Illinois, Urbana. 564 pages. Grune & Stratton, Inc., New York, N. Y., publishers, 1952. Price $10.

Although this book is long and thick and hard to read, it deserves attention for 2 reasons. *First,* the author presents an excellent summary of ego development, drawing on a great variety of sources, many of which are little known or not readily accessible to the average psychiatrist. *Second,* the work is valuable because of its critical contribution. The author steps on so many toes that no one can complain of having been singled out or can boast of having escaped unscathed.

The work is in 4 parts. The first, dealing historically with personality development, is regrettably brief. In part 2 the ego development of the child is ably depicted but childhood sexuality is ignored or evaded. The author introduces the term "satellization" for the optimal type of identification. He divides all of us into satellizers and nonsatellizers. The former may acquire minor developmental defects or can even become inadequate psychopaths with extraversion and reality gratification of hedonism or evolutionary (in contrast with reactive) schizophrenics (usually hebephrenic or simple type) with intraversion and fantasy gratification of hedonism. Nonsatellizers, on the other hand, are heir to all other psychopathology including the neuroses, psychoses, alcoholism, delinquency, adolescent emancipation problems, and aggressive antisocial psychopathy.

In part 3 the author recapitulates part 2 and points out developmental pitfalls leading to psychic disorders. His delineation of the development of conscience and his discourses on ethics and moral responsibility are especially good. He takes sharp issue with the overwhelming majority of psychologists, sociologists, and psychiatrists who hold implicitly or explicitly to one or another variety of determinism and who deny the relevance of objective ethical norms to science or the relevance of science to ethics. He insists that there is both philosophic and psycho-

logic justification for ascertaining degrees of responsibility and guilt and in using punishment intelligently. He is scathingly critical of lax public morality and the overly permissive upbringing of children. He does not advocate a return to rigid authoritarianism, but he advocates appropriate firmness and the use of punishment as well as praise.

Part 4 presents the author's classification of mental disorders. He is skeptical of the prognosis in nonsatellizers, especially critical of psychotherpaeutic promises including hopes of rebuilding personalities or permanently eradicating symptoms. Therapists are seen as too permissive and as condoning immorality by silence. In psychologic orientation, the author seems to be informed chiefly by Cantril and Sherif. Freudians, neo-Freudians, and analytically oriented psychologists are criticized as being dogmatic, obscure, and contradictory. They might in turn accuse him of ignoring a whole mass of evidence evolved painstakingly by psychoanalysis and having numerous instances of internal and external validation in its wake. In a work so outspokenly dedicated to the study of the ego, it is curious to discover omission of such outstanding and active contributors to ego psychology as Hartmenn, Kris, and Loewenstein.

A note of pessimism pervades the volume. Our culture is seen as pathogenic, dog-eat-dog, and devoid of an equitable valuation of persons. The author thinks that society must get worse as a prelude to improving. He assumes without adequate support that there are fewer opportunities for youth today.

I recoil from his use of the commercial-legal term "hypothecate" in place of the philosophic-scientific verb "hypothesize." Another annoyance is his tendency to redefine words and then criticize the usage by those who have employed them differently in the past. For example, "insecurity" suddenly replaces "anxiety," and woe to him who inadvertently failed to anticipate this new terminology!

This volume attempts to formulate a systematic theory of psychopathology based on a nonpsychoanalytic interpretation of personality development. The author is reasonably consistent internally, but he disparages and discards more baby than bathwater when he dismisses whole sections of hard-earned psychoanalytic theory and therapy. Only through attempts like this, however, can the convergence of our science to the common path of established fact and optimal functional usefulness come about. The theory of psychosexual development and its relation to ego psychology deserves research and critical study in order to achieve depth, breadth, and greater accuracy. Discarding it in toto is inviting a return to the psychologic Dark Ages.

The author seems unnecessarily to oppose the concepts of conflict and the unconscious. His plea for more investigation, correlation of interrelated disciplines, and clarification of vocabulary is sound. From the viewpoint of his *contributions* to theory we shall be grateful to him, but we would hardly wish to take his gifts at the price of losing those aspects of our psychoanalytic heritage which he condemns and decries.

—*Lt. (jg.) E. A. Loomis, Jr., MC, U. S. N. R.*

Surgery of the Chest, A Handbook of Operative Surgery, by *Julian Johnson,* M. D., D. Sc. (Med), Professor of Surgery, School of Medicine and Graduate School of Medicine, University of Pennsylvania, and *Charles K. Kirby,* M. D., Assistant Professor of Surgery, School of Medicine, University of Pennsylvania. Illustrated by *Edna Hill.* 387 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., 1952. Price $9.

The authors have presented a step-by-step description of the technical details of established thoracic surgical procedures. Essentially all of the common thoracic operations are described clearly and concisely in this small volume. Throughout the book, in describing operative procedures, the text has been placed on one page and the illustrations of that particular operation on the facing page. This arrangement is convenient and greatly facilitates a clear understanding of the procedure being discussed.

The first 54 pages deal with the surgical physiology of the thorax, diagnostic measures employed in evaluating surgical disorders of the chest, evaluation of the general condition of the patient, pulmonary function tests, preoperative and postoperative care, and general operative considerations. It is impossible to discuss these subjects thoroughly in so little space and the necessity or desirability of attempting to do so in a manual that is avowedly devoted to surgical technic is doubtful. Most of the material in this opening chapter could have been omitted without detracting from the merits of the book.

Succeeding chapters deal with chest injuries, operations for empyema and lung abscess, thoracic incisions, and the surgical anatomy of the lungs. There follow chapters on various pulmonary resections, including pneumonectomy, lobectomy, segmental resection; special problems, including cardiac arrest, which may arise during major thoracic procedures; operations on the esophagus, the heart and great vessels, and the lungs in patients with pulmonary tuberculosis; and miscellaneous thoracic operations. The technical descriptions comprise the meat of the book and almost without exception the operations are authoritatively described and clearly illustrated. Because the surgical

treatment of pulmonary tuberculosis is practically a specialty in itself, the wisdom of devoting 2 pages to the selection of patients with pulmonary tuberculosis for surgical treatment must be questioned. A problem of such complexity deserves much more detailed consideration than could possibly have been given it in a volume of this type.

This book will be of the greatest value to students, to practitioners who wish to acquire an understanding of the various thoracic surgical procedures, and to qualified general surgeons who are undertaking training in the specialty of thoracic surgery. The volume is well printed, adequately indexed, and free of typographic errors.—*Capt. C. F. Storey, MC, U. S. N.*

Ambulatory Proctology, by *Alfred J. Cantor,* M. D., Proctologist, Kew Gardens General Hospital, Long Island, N. Y.; Formerly Assistant Attending Gasteroenterologist, Queens General Hospital; Assistant Adjunct Proctologist, Hospital for Joint Diseases, New York, with a Foreword by *Beaumont S. Cornell,* M. D., Editor, American Journal of Digestive Diseases. 2d edition, revised. 563 pages; 382 illustrations. Paul B. Hoeber, Inc., New York, N. Y., publisher, 1952. Price $10.

This book supports the current trend toward early ambulation even after major operations. As the title would suggest, the diagnosis and treatment of diseases of the anus, rectum, and sigmoid without confining the patient to bed is the primary objective. It is completely attained, in large part due to the mechanical ingenuity and creative ability of the author. Even radical proctologic surgical technics are described and illustrated, and ambulation in patients on whom these technics have been used is advocated and made possible, no doubt, by the use of oil-soluble anesthetics, the newer hemostatic agents, and antibiotics.

An entire chapter is devoted to the thermal cutting unit and another to the treatment of pruritus ani with the reciprocating hand piece and flexible shaft tattoo instrument designed by the author. Although the chapters on ulcerative colitis and the dysenteries leave much to be desired from the standpoint of the gasteroenterologist, they are well written for the proctologist. This book is well illustrated and the bibliography at the end of each chapter is complete.

—*Commander L. J. Pope, MC, U. S. N.*

Physical Diagnosis, by *Harry Walker,* M. D., F. A. C. P., Professor of Clinical Medicine, Medical College of Virginia, Richmond, Va. 461 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., publisher, 1952. Price $8.

The author, with the help of other faculty members of the Medical College of Virginia, has produced an excellent book on physical diagnosis, notable for its clear writing and complete-

ness. It would appear to be especially valuable for medical students because such basic subjects as the clinical thermometer and the technic of percussion, are described in great detail. The significance of usual physical signs and symptoms is pointed out in simple language. In addition, note is made of the fact that night sweats are not helpful in the diagnosis of tuberculosis, that duskiness of the infraorbital areas does not indicate disease, et cetera. Besides 23 chapters on the usual physical examination in proper sequence, there are special chapters on the diagnosis of female pelvic disease and neurologic and psychiatric examination. The last section of the book describes the pathology, physical signs, and diagnosis of diseases of the respiratory tract and circulatory system. For the medical student and intern this section should prove especially valuable because theoretical discussion has been practically eliminated and only essential facts are given. The illustrations are excellent and greatly aid in the understanding of the text.

—*Col. W. H. Diessner, MC, U. S. A.*

Gastrointestinal X-ray Diagnosis, by *Max Ritvo,* M. D., Assistant Professor of Radiology, Harvard Medical School; Instructor in Radiology, Tufts Medical School; Director, Department of Radiology, Boston City Hospital; Associate in Radiology, Beth Israel Hospital, Boston, Mass., and *I. A. Shauffer,* M. D., Instructor in Radiology, Harvard Medical School; Instructor in Radiology, Tufts Medical School; Visiting Radiologist, Boston City Hospital. 838 pages; 470 illustrations, 2 in color. Lea & Febiger, Philadelphia, Pa., publishers, 1952. Price $20.

This is an excellent reference book, not only for the roentgenologist, but for the surgeon and internist as well, providing for each a means of understanding the problems of the others. Not only are roentgenologic methods of diagnosis discussed in detail, according to findings relative to each organ of the gastrointestinal system, but the anatomy, embryology, and physiology are reviewed in each instance. The lesions of each part are described in detail, including clinical signs and symptoms, methods of roentgenologic examinations and pertinent findings, differential diagnosis, and accepted therapy. The arrangement of subject material follows a well-established pattern and the presentation, though detailed, is clear, concise, and practical with a minimum of ambiguity and a minimum of discussions of unproved theory. Although the amount of detail precludes reading for pleasure, the phrasing and terminology is such that understanding of the subject matter is easily within the grasp of any physician. There is an interesting treatise on the history and development of roentgenologic methods of gastrointestinal diagnosis. The illustrations are superior, both in choice and reproduction. The bibliography at the end of each discussion is extensive and should be of great assistance to the specialist.

—*Lt. J. H. Lawson, MC, U. S. N.*

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OXYGEN VS. OXYGEN-CARBON DIOXIDE IN RESUSCITATION[1]

DAVID B. DILL, *Ph. D.*

THE advisability of adding carbon dioxide to oxygen for resuscitation has been debated for more than 30 years. In the case of resuscitation from carbon monoxide poisoning an affirmative recommendation was made in 1923 by a Commission appointed at the request of the American Gas Association (2). The Commission was composed of 9 eminent physiologists and experts in clinical medicine, including as chairman, C. K. Drinker. Two of the physiologist members, Henderson and Haggard, had advocated the use of such a mixture for several years prior to the authoritative endorsement by the Commission. The Commission condemned the "pulmotor" and "lungmotor," preferring manual artificial respiration by the Schafer prone pressure method, if breathing had stopped. The Henderson-Haggard "inhalator," using 5 percent carbon dioxide in oxygen, was approved (3).

Although some members of the Commission subsequently reached different conclusions, Henderson never wavered. His vigorous arguments were reiterated in 1938 (4) and again in 1943 (5). The most desirable concentration of carbon dioxide was investigated by Drinker and his associates. The results, summarized by Drinker (6), led to the adoption of 7 percent carbon dioxide in oxygen. This mixture has become known as "carbogen."

The past 10 years have seen notable advances in the field of artificial respiration. A new manual method has been adopted in this country (7), and several mechanical devices have come into

(1) From the Chemical Corps Medical Laboratories, Army Chemical Center, Md.

(2) Drinker, C. K.; Cannon, W. B.; Edsall, D. L.; Haggard, H. W.; Henderson, L. J.; Henderson, Y.; Peabody, F. W.; Sayers, R. R.; and Scott, C. B.: Final report of commission on resuscitation from carbon monoxide asphyxia; treatment of carbon monoxide asphyxia. J. Industrial Hygiene 5: 125-129, 1923-1924.

(3) This apparatus is manufactured by the Mine Safety Appliances Company.

(4) Henderson, Y.: Adventures in Respiration. Williams & Wilkins Co., Baltimore, Md., 1938.

(5) Henderson, Y., and Haggard, H. W.: Noxious Gases and the Principles of Respiration Influencing Their Action. 2d edition. Reinhold Publishing Corporation, New York, N. Y., 1943.

(6) Drinker, C. K.: Carbon Monoxide Asphyxia. Oxford University Press, New York, N. Y., 1938.

(7) Dill, D. B.: Manual artificial respiration. U. S. Armed Forces M. J. 3: 171-184, Feb. 1952.

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